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**Job in the digital age.  
A SLR on old and new  
knowledge, skills, and  
competencies.**

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# INTRODUCTION

## Labour market and the digital transformation

Digital transformation has deeply impacted the labour market: from the introduction of the Internet of Things (IoT) to robots, from remote working to the informative overload, the circumstances in which employees have to perform their job have quickly and profoundly changed over the past decades.

For many employees, daily tasks have become more complex because they are required to be more flexible with other workers, to interact with machines and demonstrate adaptive capabilities in a very dynamic working environment. (Longo et al., 2017). The request for new knowledge, skills, abilities, and competencies (KSC) has considerably emerged being consistent with the birth of new types of jobs and the change of the existing ones. The adoption of digital technologies is shaping the actual and future trends in labour markets affecting the establishment KSC workers have to possess, the types and number of work activities they can perform and the rise of a new set of competencies consistent with the new forms of work. Digital transformation leads companies to growth, innovation, and the creation of job occupations and, at the same time, it requires new digital, technological, and creative capabilities.

In the dissertation, we adopt and analyze two distinct terminologies which are common to most of the large corpus of literature reviewed: knowledge skills and abilities (KSA) and knowledge skills and competencies (KSC).

The KSA model is known as Bloom's taxonomy (1956) and it is based on three domains of educational activities:

- The cognitive domain consists of recalling and recognizing knowledge and it concerns the development of "*intellectual abilities and skills*".
- The affective domain "*includes objectives that describe changes in interest, attitudes, and values and the development of appreciations and adequate adjustment*".
- The manipulative or motor-skill domain regards manual or physical skills. (Bloom, 1956: p. 7).

A more specific terminology concerning learning outcomes is KSC where abilities are replaced by competencies. The European Commission (2008: p. 5) assumes that the

differentiation between these terms is a “*pragmatic agreement*” among the various approaches to the topic. Even though the commitment in defining each of these concepts is growing: “*these three categories (KSC) should not be read in isolation from each other, but they should be collectively perceived*” given the many interconnections and relations.

## **Purpose of study**

The aim of the research is to review the evolution of KSC as a consequence of digital transformation. From a theoretical perspective, the thesis focuses on three related objectives: i) to provide definitions and specific meaning of these concepts in the digital economy ii) to investigate the new role that KSC are assuming in labour markets and iii) to monitor the emerging trends that are shaping their evolution.

The scholarly work on this topic is very large and developed over different often contrasting literature streams. The main contribution of the thesis is to review the major achievement in each relevant disciplinary approach and lead back the arguments to a more comprehensive perspective.

Different research questions recurrently arise from papers: what key definitions are relevant to identify a job, a task and employee characteristics? What is the difference between KSA and KSC and how are they related to each other? What kind of characteristics are required by the digital economy? Are they more technical or creative? The interest in these questions comes from different disciplines and industries because of the rising awareness of possible future shortcomings in the labour market, together with the consciousness of the possibility of solving them through concrete policy interventions in the present.

Two main reasons explain why KSA and KSC have raised interest, especially in the actual knowledge economy. First, KSC meaning and their evolution are crucial in several fields of study: from sociology to labour economics, from psychology to firm management, not least innovation, and technology studies. The versatility and breadth of these elements make their comprehension a priority for many sectors. With a focus on our research, they are useful tools in the description of job occupations, characterizing employers' requests and workers' intellectual development. Second, the growing importance of human capital and its elements as value drivers of innovation and growth. In the complex and dynamic business ecosystem of today, characterized by continuous change and adaptation, the



sources of competitive advantage are becoming more difficult to find and maintain. Great merit has been given to intangible resources in creating value within and outside the organization, hence, they are fundamental both for individuals, such as workers or citizens, and organizations, such as companies and policymakers.

## **METHODOLOGY**

### **Systematic Literature review**

From a methodological perspective, the thesis is based on a systematic literature review (SLR) which *“is a literature review focused on a research question that tries to identify, appraise, select, and synthesize all high-quality research evidence relevant to that question”*. (Byrne, 2017)

Given the different and often contrasting literature streams on the topic, a SLR is the best qualitative methodology to address the problem. The main principles we decided to follow in conducting our SLR are the six suggestions that Fisch and Block (2018) provided for carrying out a literature review in business and management research. Their six criteria are clear and concise and thus precious for developing an equally comprehensible and useful SLR.

The review includes the literature concerning the concepts of KSA and KSC, even if the vast majority of the research is dedicated to the terms of knowledge, skill, and competence. The reason for this is that Bloom’s KSA model has provided the foundation for the birth of the most recent and frequently used KSC acronym. This latter needs wider investigation also because of its intensive use since the 2000s (Le Mouillour, 2005; Markowitsch and Luomi-Messerer, 2008) until the most recent papers and official documents (Delamare Le Deist, Winterton and Stringfellow, 2006). The great amount of research about KSC led to confirming the need for a SLR to analyze and synthesize the huge existing knowledge. In particular, the review investigates the topic from different perspectives and considers the evolution of the concepts during the time until evaluating the newest, digital, and emerging KSC of the 21st century.

The reasons why we decide to address a SLR on the issue are mainly two. First, the scholarly research about these concepts is vast and various and it touches as many interpretations as are the disciplines that involve them. Each of these streams of literature

investigates the features that are relevant for its epistemological frameworks and research community. The multifaceted context justifies the existence of a myriad of possible interpretations and assumptions on KSC. Hence, the need for a synthesis of the information available highlights the possibility of using a SLR that identifies, analyses, summarizes and categorizes the huge existing knowledge. Second, after having determined the meaning and composition of KSC, a SLR can be useful to evaluate which are the most relevant KSC for employees working in the 21st century and in the next future years. Digital transformation is revolutionizing labour markets and it is becoming difficult to identify which are the best and more useful KSC to remain active workers in a more and more computerized workplace. The presented SLR has the aim of solving this identification problem by providing some literature-based frameworks.

### **Documents selection: three perspectives plus one**

The SLR is structured with a focus on concepts, instead of studies. As we have explained above, the most interesting part of the analysis concerns the concepts of KSC in relation to the context or discipline in which they are referred. For this reason, we decided to study these concepts from three principal perspectives: educational sciences, human resource and organization's management and labour economics.

The analysis and literature search were conducted following these three fields of investigation, whose choice is justified by the fact that they are the principal contexts in which KSC can be acquired and put into practice. In particular, educational sciences have focused on the acquisition and development of KSC, while human resource management considers their application in the workplace. Labour economics is important since KSC affects the equilibrium of the labour market. The match between KSC required by employers and the ones possessed by workers is the optimal point that regulates all the labour market dynamics.

Finally, in the SLR we included the perspective of international organizations since institutions like OECD, UNESCO and WEF (fully described in the dedicated chapter) have a crucial position in setting rules and actions affecting all the actors involved, from citizens to workers, from companies to educational institutions. Moreover, institutional policies derive from the combination of the information and knowledge coming from the other three literature perspectives.

The longitudinal choice of the above perspectives is based on the concept of lifelong learning that has been defined by the UNESCO Institute for Lifelong Learning (UIL, 2021) as *“rooted in the integration of learning and living, covering learning activities for people of all ages (children, young people, adults and the elderly, girls and boys, women and men), in all life-wide contexts (family, school, the community, the workplace, and so on) and through a variety of modalities (formal, non-formal and informal), which, together, meet a wide range of learning needs and demands”*. This unlimited learning approach guided us in the development of the study and the presentation of the results, covering all the possible aspects in favor of an economic and social capital improvement.

Both the United Nations and the European Union stressed the role of lifelong learning in accomplishing social well-being. The United Nations (2015: p.14) in the fourth Sustainable Development Goal (SDG) of the 2030 Agenda for Sustainable Development states that we have to *“ensure inclusive and equitable quality education and promote lifelong learning opportunities for all”*. The European Union through the first principle of the European Pillar of Social Right argues that *“everyone has the right to quality and inclusive education, training and life-long learning to maintain and acquire skills that enable them to participate fully in society and manage successful transitions in the labour market”*. (European Commission, 2018: p. 11) It is *“by instilling a genuine culture of lifelong learning that we can ensure a competitive economy and cohesive society”*. (European Commission, 2020a: p. 15) This explains the struggle and the commitment of all actors to guarantee lifelong learning to everyone and everywhere, pursuing sustainable development not only from the economic and environmental point of view but also fostering its social pillar.

## **Databases, search terms and reference journals**

The databases where the literature search was conducted are Google Scholar and annexed highly ranked journals.

Some search terms used to identify literature are in common with all the considered perspectives, others are specific to one or some of them. Some of the formers are *“knowledge”, “skill”, “competence”, “abilities”, “KSC”, “KSA” and “human capital”*.

For the search of documents concerning educational sciences, we used further keywords together with the more generic ones like *“education”, “learning process”, “psychology”,*

“human development” and “social sciences”. Chapter 1 is the outcome of a SLR of several documents that address the topic from an educational point of view. Some examples of journals we cited are *Review of Educational Research*, *Educational Psychologist*, *Journal of Competency-Based Education*, *Social and Behavioral Sciences*, *Journal of Intellectual Capital*, *Journal Contemporary Issues in Education Research*, *Journal of Human Development* and *Review of Educational Research*.

The search for human resources and management literature has been conducted using more specific terms like “human resources”, “human resource management”, “company management”, “training”, “on the job training”, “occupation” and “workplace”. The main journals we have referred to are *Work and Occupations*, *Industrial and Commercial Training*, *Management Decision*, *International Journal of Business and Systems Research*, *Human Resource Development International*, *The Journal of Business Strategy*, *Association of International Management*, *European Management Journal* and *Journal of Management & Organization*.

The specific keywords used for searching institutional organizations’ information are mainly the generic ones mentioned above, but the search was conducted within online libraries and websites of the most important organizations such as UNESCO, OECD, WEF, ISFOL and related KSC portals like ESCO and O\*NET. Most parts of the documents cited in the related chapter are from these institutional organizations.

The SLR concerning labour economics considered the following search terms “demand and supply of”, “labour market”, “employment and unemployment”, but also the keywords concerning the emerging trends like “21st-century skill”, “STEM”, “STEAM” and “digital”. Some of the journals considered are *Industrial and Labor Relations Review*, *The Quarterly Journal of Economics*, *Journal of Economic Geography*, *Annual Review of Sociology*, *Review of Economics and Statistics*, *International Journal of Innovation, Creativity and Change*.

Considering the time frame of the publications reviewed, we have included both studies of past years and the most recent ones too. The former helps to investigate the solid theoretical basis on which the most recent findings rely; while the latter provides the information and results of contemporary research, especially concerning the effects of digital transformation.

## **Structure of the paper**

The first chapter reviews the literature of educational sciences that for simplicity will be called Topic 1 and it considers the acquisition of KSC through learning processes and, more in general, presents how they are related to education. Young people either acquire KSC through formal education or they can be innate in the person. Assuming that the learning process never stops (lifelong learning), it is very important to individuate how the journey starts because it can explain the person's future approaches and affect potential gaps in adulthood. This perspective is relevant because it explains how academic and vocational systems are set up and it contributes to understanding the value individuals give to the different learning outcomes, depending on the stage of their education.

Chapter 2 focuses on human resources and management (Topic 2). A SLR in the field of business management has been necessary because KSC defines the quality and the features of human resources. Indeed, one of the research questions concerns the identification of the KSC people should possess to be active participants of the workforce. Moreover, the analysis of the management perspective is very useful to comprehend why these human capital elements are gaining importance within various industries and, overall, in the knowledge economy.

Chapter 3 catalogues and summarizes the institutional perspective (Topic 3) by collecting and analyzing the studies of major international organizations about the concepts of KSC and their relations. The results of these institutional studies can be translated into many taxonomies with the purpose of providing a common and objective understanding on which policymakers can rely.

At the end of each chapter, there will be a table to collect and summarize the findings according to each Topic. The comparison between these results will be illustrated in the first part of Chapter 4 throughout a final matrix that will help us to find the specific meaning of the concepts of KSC.

The last chapter presents the final results according to the perspective of labour economics (Topic 4). It provides the solution to the three main purposes of the thesis: respectively, it defines the meaning of KSC, explains their new role in digital labour markets and monitors the emerging trends shaping job and skill evolution.

The outcome of this SLR not only clarifies and synthesizes existing knowledge, but it

makes evidence of the potential gap between labour market demand and supply of KSC in the future. Analyzing labour market dynamics, we found potential threats related to the skill gap and mismatch caused by digitalization and ICT. We brought to light that by pursuing upskilling, reskilling and lifelong learning in schools and workplaces the future inconsistencies could be solved.

Focusing on the emerging jobs and on the evolution of the existing ones, we individuate two principal conditions that are shaping the next generation occupations: digitalization and human interaction. The latter are merged in the so-called skills of the future or 21st-century skills. The contribution of our research on the topic is the forecast of a potential gap in the demand for such skills due to the deficiencies in the education systems and training programs. Furthermore, we discover that the best solution to such inconsistencies is about the implementation of Arts (creative disciplines) in the STEM approach (technical disciplines) to education and learning systems. Artistic and creative contexts lead people to develop high order KSC but also to nurture a sense of belonging to a community and of being an individual with a relevant and unique value. *“By acknowledging the role of the arts in our lives and in education, we acknowledge what makes individuals whole”*. (Bucheli et al., 1991)

# **CHAPTER 1: PERSPECTIVE OF EDUCATIONAL SCIENCES**

## **INTRODUCTION**

Chapter 1 attains to provide the meaning of the concepts of KSC addressing the subject according to the perspective of educational sciences (Topic 1). It investigates the definitions of the principal learning outcomes in relation to the value of education and focuses on the role this latter has in affecting the acquisition and development of KSC.

The chapter starts with a premise: the awareness of living in a new digital and knowledge-based society together with the growing importance of education as a means to pursuing social cohesion, one of the three fundamental pillars of sustainable development.

The first part of the discussion regards learning and education processes, which are investigated in their meaning, steps, and outcomes; after that, the meaning of human capital is studied first as an individual investment and then as a valuable result for the whole society.

The second part of Chapter 1 concentrates on the SLR of the meanings of KSC. The findings are provided in a structure that will be recalled in the next chapters with the aim of providing the same conceptual framework from different perspectives, so as to highlight the main similarities and differences at the end of the dissertation. The common part for all the chapters is a final table that provides a comprehensive definition for each of the concepts of KSC that have been achieved by summarizing and merging the different definitions of the many perspectives.

## **Knowledge society and Education for sustainable development**

The multifaceted and complex environment in which organizations and people have to operate is characterized by rapid production and circulation of knowledge, new and different sources of information and widespread dissemination of communication technologies. (UNESCO, 2013: p. 14) All these characteristics defined the so-called knowledge economy, a term coined by Breslow around the '90s who recognized that the world was changing and especially the world of work. This new type of economy is characterized by a series of work and daily activities that need a level of expertise to deal with ideas, people and/or systems rather than physical objects. (Breslow, 2015: p. 421) In this form of economy, businesses that operate in this market are knowledge-based too.

Knowledge-based industries usually refer to all industries that make intensive use of technological inputs and/or human capital. (OECD, 1999)

The pervasiveness of knowledge does not finish in the economic field but it extends through society in general, naming the concept of a knowledge society. Weatherly (2003: p. 3) strengthens the concepts saying that “*we have moved from an industrial society, where the primary source of wealth was machinery, to a knowledge society, where the primary source of wealth is human capital*”. In this knowledge-based society, the concern on sustainable development, and in particular on the social capital pillar, is growing rapidly. It is demonstrated by the growing attention of scholars and organizations in recent years on the topic of human capital development.

The close relationship between education and sustainable development is collected in the concept of Education for Sustainable development (ESD). It is a specific type of education characterized by a focus on content and learning outcomes, pedagogy, and the learning environment. People, as citizens of the community in which they live, have to pursue sustainable development using the knowledge, skills, values, and attitudes they possess. (González-Salamanca, Agudelo and Salinas, 2020: p. 2)

The OECD sustains ESD too (2019: p. 167) arguing that education and training systems should be established and developed in line with the need for skills and values that enable people to operate and survive in the digital and innovative 21st-century. These qualifications allow better quality conditions both in the working environment but also in daily life. Many governments and institutions worked, and are still working together, to create a common set of educational requirements to ensure a level of understanding sufficiently consolidated to assure normal daily life standards to everyone. The economic, environmental, and social sustainability are generally growing in relevance: for the discussion of Chapter 1, focusing on education, the attention moves on the social pillar which is interested in people and social welfare.

## **LEARNING PROCESS**

### **General meaning and types of learning**

From a psychological perspective, learning is seen as a form of adaptation to the surrounding changing environment to survive challenges in the long run. (Dodgson, 1993: p. 378) This is one of the main reasons why the concept of lifelong learning has gained



importance in the recent decades of the knowledge society.

In 1986, Shuell investigated many perspectives about the concept of learning. The behavioral orientation assumes that learning includes all the *“factors and/or variables that influence changes in human performance, knowledge structures, and/or conceptions”*. (p. 411) The author's contribution highlights the effects the external environment has on a person's knowledge or abilities. The introduction of cognitive conception leads to a more active process of learning: it is constructive and goal-oriented and it depends on the learner's intentions. (p. 415) This new conception of learning has been accepted by many other scholars leading to the actual definition of learning as the process of acquiring knowledge. It is considered both a process and the result of that process, affirming that learning can be defined also as a multifaceted reality defined by the context. (UNESCO, 2015: pp. 16-17)

The no-stop and adaptive learning process is a concept introduced by Delors et al. in 1996 (p. 35), who defines lifelong learning's precursor as *“education throughout life”*. The new and broad perspective of Delors et al. is based on four pillars:

- Learning to know pillar concerns the combination of broad general knowledge with the opportunity to work in-depth on some specific subjects to provide solid foundations for future learning throughout life.
- Learning to do pillar stresses the acquisition of competencies and skills that enables people to deal with the complex and dynamic circumstances of the knowledge society. They should enable them to make use of all the learning methods available, from formal education to work experiences.
- Learning to live together pillar argues that an understanding of others in terms of history, values, and traditions *“induce people to implement common projects or to manage the inevitable conflicts in an intelligent and peaceful way”*. (p. 20)
- Learning to be pillar emphasizes the importance of developing an individual's personality enlarging their *“autonomy, judgement and personal responsibility”* (p. 35) throughout education.

The growing attention on the learning process and its characteristics are due to the prominent necessity to face the challenges and to grasp the new opportunities of the knowledge society. Even though the four pillars have to be adapted to the situation at hand and the Delors' report is theoretical and dated, the use of this framework is a model that still inspires policymakers in their decisions towards learning throughout life and the

community wellbeing.

The general purpose of lifelong learning can be translated into concrete forms of learning that have been individuated by the European Commission (2000, p. 8):

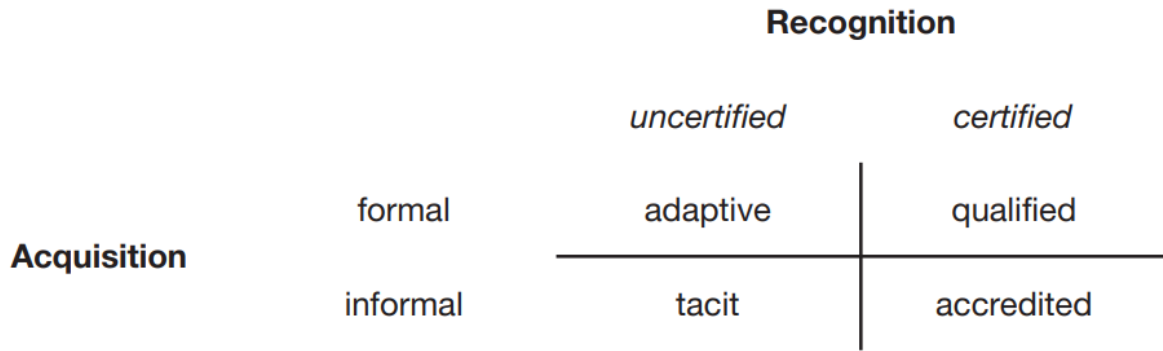
- Formal learning, which is performed by education and training institutions, is “structured in terms of learning objectives, learning time, or learning support” (Rubenson, 2010: p. 3). The learner has the intention to complete this practice the outcome of which are recognized diplomas and qualifications.
- Non-formal learning takes place at the same time as the systems of education and training but it is external to such institutions. It does not conclude into formalized certificates, even though it is structured learning. It can take place in performing work activities, in civil society groups or other services organizations’ activities (e.g., sport, music, art... clubs).
- Informal learning “is learning resulting from daily life activities related to work, family, or leisure” (Rubenson, 2010: p. 3). It is not structured and certified because it often happens unconsciously.

These three forms of learning are characterized by different styles and levels of certification, intentionality, and formalization, but they have in common the acquisition and improvement of KSC.

### **Formation and recognition of KSC**

With a focus on KSC acquisition, Winterton et al. (2006) individuate four types of formation and recognition of KSC which range from (Figure 1):

- Tacit KSC that are acquired informally and they are not recognized by any certification.
- Qualified KSC that are gained through formal systems of education and training and their recognition is certified.
- Adaptive KSC concern formal acquisition but they are not certified.
- Accredited KSC or “informal experiential learning” that is certified but acquired throughout informal processes. (Winterton et al., 2006: p. 22)



**Figure 1:** Routes of formation and recognition of KSC. (Winterton et al., 2006: p. 21).

We dedicated an excursus about the meaning of learning, the steps people go through in this process and the outcomes of such learning methods because we believe that they are necessary to comprehend the value of education and of the point of view of Topic 1.

## **EDUCATION**

### **General meaning**

The concept of education has been defined by UNESCO (2015: p. 17) as deliberate, intentional, purposeful, and organized learning characterized by a certain degree of institutionalization. As in the case of the learning process, education can be formal or non-formal depending on its level of certification and intentionality. The situation in which education is less deliberate, organized, and structured is called informal education. It is not necessarily acquired through institutional forms of education and training but it can be gained through learning activities performed in the workplace or daily life. (UNESCO, 2015: p. 17)

In studying informal learning, closely related to informal education, Cullen et al. recognized a shift in the recent theories: from the individual activity and personal KSC to a focus on the social dimension. Informal learning and education are not seen as primarily individual-related, but their benefits are broader and associated with social capital, capacity-building, and citizenship. (Cullen et al., 2000: p. 7) From this wide and overarching interpretation, we can gather the role and value of education both for governance and, in general, for the single person in its daily life. Education affects both individuals' personal growth and the economic, social, cultural, and environmental

development of society, recalling the extending utility of ESD. (UIL, 2021)

From Delors, as a pioneer, until the objectives established by the 2030 Agenda for Sustainable Development, the concern on education as a common good has grown. In the last decades, especially as a consequence of the digital transformation, the struggle to make education a common good has become part of the future development policies of more and more countries. These theories of thought are based on the premise that *“whether or not expanded educational opportunities will translate into meaningful development... [depending on] whether people learn as a result of those opportunities, i.e., whether they incorporate useful knowledge, reasoning ability, skills, and values”*. (UNESCO, 1990: p. 9) UNESCO stresses the importance of KSC acquisition for human capital evolution and social cohesion. Furthermore, many institutional actions that aim at making free and available the possibility of learning for everyone are raising, seeking to reduce educational discrimination in terms of age, gender, nationality, level of education and disposable income.

In the complex circumstances of today’s environment, characterized by continuous progress and almost daily technological innovations, education is understood not as an end product of one stage of human life, but as an ongoing process. (Lapina and Aramina, 2011: p. 142) Education is a *“multidisciplinary process...[that] aims to provide the knowledge that improves professional qualifications and to achieve civic, social, moral and cultural attitudes and skills for performing responsibilities and programming all spheres of life”*. (Martínez de Morentin de Goñi, 2006: p.119)

### **Academic and Vocational education**

There are several types of learning processes depending on the people’s age, the intentionality of the process, its certification, the context in which it happens and the final scope of learning.

A common way to measure the acquired education among individuals is the level of qualification. It considers two dimensions: first, the level of education and training received through formal educational systems that can be recognized by a qualification framework; second, the level of proficiency received in non-formal or informal circumstances. (CEDEFOP, 2014: p. 168) As mentioned before, the context and intentionality of the learning process result in different levels and types of outcomes.

In 1999, Blundell et al. affirm that *“there are three main components of human capital: early ability (acquired or innate), qualifications and knowledge acquired through formal*

*education, and skills, competencies and expertise acquired through training on the job*". (p. 2) The two processes, formal education and on-the-job training are both focused on the acquisition of new learning outcomes, even if there are some differences between the two. Academic education refers to the years of schooling, mandatory or not, that leads to learning both theoretical and practical KSC but not necessarily related to the future career of the individual. The institutional providers of education and training furnish the basic KSC that will be the foundation for the attainment of further education and training. Complementary to this formal education there is the training on-the-job. Adapted from European Training Foundation (ETF, 1997), CEDEFOP (2014: p.128) defines vocational education and training (VET) as the process that "equips people with knowledge, know-how, skills and/or competencies required in particular occupations or more broadly on the labour market". In detail, on-the-job training is the VET provided and attained in the workplace. It can be the total amount of training or be combined with off-the-job training. (CEDEFOP, 2014: p.188)

Many researchers try to identify which of these learning processes is the most effective, remunerative in students' future and the one that ensures greater benefits in terms of society's welfare and company competitiveness. The study of Kang and Bishop (1989: p. 143) contributes to the subject affirming that a complete specialization in vocational formation or on-the-job training that undervalue the basic skills is not profitable compared to an individual education based on both vocational and academic training. The authors demonstrate that both types of learning are necessary for constituting a beneficial educational system, both for individuals' backgrounds and the community's success. From a collective point of view, policymakers have to balance vocational and academic education in setting educational objectives. From an individual perspective, people choose one or the other depending on their educational trajectories and on their different cultures and traditions. (Busemeyer, Cattaneo and Wolter, 2011) That is for these reasons that government institutions have to take into consideration the actual digital trends and individual preferences to ensure the best offer possible in terms of basic and advanced KSC.

The management of these two learning processes is in line with their shared final purpose: both academic and vocational education enhance people's knowledge background and their future job performance, providing workers with the necessary tools to complete work activities and giving them the tools to be active citizens.

# HUMAN CAPITAL

## General meaning

The history of human capital goes back to the 18th century, with Adam Smith who wrote one of its first definitions: *“The acquisition of...talents during...education, study, or apprenticeship, costs a real expense, which is capital in [a] person. Those talents [are] part of his fortune [and] likewise that of society”* (Smith, 1776: p. 217).

Smith (1776) exposed his idea of the concept and became one of the pioneers of the subject, highlighting for the first time its value, not only for the individual itself but mainly for the society as a whole. He theorizes those human beings can learn and improve their abilities through education and training, and these ideas are still today the main objects of research.

Human capital has been studied by many researchers of many ages. The differences characterizing each historical period and field of study result in a myriad of definitions of the concept. Every author highlights the features most likely to be present in its specific time and discipline, belonging to a specific research community.

An interesting point of view about this resource is the one proposed by Gary Becker. The author refers to human capital as *“the knowledge, information, ideas, skills, and health of individuals”*. (Becker, 2002: p. 3) This first interpretation introduces the concepts of KSC. Some years before writing this definition, Becker (1994: p.16) recognized the *“embodiment of human capital in people”* affirming that you cannot separate a person from these characteristics. Human capital can be considered as the comprehensive accumulation of individual KSC or as the people themselves, comprehending all their characteristics like knowledge, skills, competencies, attitudes, values... Similarly, to Becker findings, also Khalique et al. (2011: p. 344) recognized that human capital includes knowledge, competence, skill, capability, and innovation.

## Human capital as investment

Many authors and theorists have provided their interpretation of human capital as an investment carried out by the individual for itself or by the government for the whole population through the definition of educational offerings. Education is one of the many ways through which human capital can be fostered, there are also practical training and daily life experiences.

In studying the relationship between human capital and education, many scholars assume that people invest in themselves, voluntarily or not, improving human capital. One of the pioneers of this current of thought was Schultz, who in 1961 started to investigate the role and value of education, training, and leisure time on individuals. He was aware that people's knowledge and skills were useful for themselves and the whole society, but their conceptualization as human capital was not already established. In his research, he also realizes that people cannot be considered as objects at the service of someone or something because "*it seems to reduce man once again to a mere material component, to something akin to property*". (Schultz, 1961: p. 2)

We examined other studies that have been executed to investigate the relevance of education in human capital future returns (e.g., Becker, 1962; Nerdrum and Erikson, 2001). In this way, the conceptualization of schooling, on-the-job training, and many other experiences as investments in human capital has been established. Higher levels of human capital can be obtained through the development of optimal educational and training solutions by governments, companies, or the individual itself.

The scholars that sustained this investment-based human capital definition are several: we focus on some examples to provide a clear presentation of the ideas. In his work "*The age of human capital*", Becker (2002) stresses the idea that investing in human capital is the way to be successful, driving innovation and obtaining economic growth. This view is particularly closely related to the context of the knowledge economy and to the concept of lifelong learning.

A similar idea is the one proposed by Goldin (2016: p. 22) who affirms that "*the stocks of human and physical capital are produced through a set of investment decisions, where the investment is costly in terms of direct costs and, for human capital investment, in terms of the opportunity cost of the individual's time*". Here the comparison between tangible and intangible assets highlights that the resources have equal value: despite its immateriality, human capital has been recognized as a source of competitiveness on a par with other already recognized sources of profit and it is produced thanks to funding it. The opportunity cost to which Goldin refers regards the many possibilities each human being has for exploiting its time and individual resources. People can decide how to spend their lives between many activities such as working, studying or leisure time: individual decisions in terms of how to spend the time are a sort of investment in human capital. Different experiences result in different outcomes in terms of KSC acquisition and

practice.

In line with this current of thought, Pasban and Nojehdeh (2016: p. 250) define human capital as “*the investment in human resources to increase their efficiency...the costs of this investment are provided for future use*”. The authors' contribution introduces another feature of human capital development: an investment as such consists of spending today for earning tomorrow. When institutions invest in training and educational proposals or individuals decide to attend a formation course, they are aware that their spending on time and money today will have an effect that will be evident only tomorrow. Potentiating the attainment and development of people KSC means boosting the level of human capital.

### **Human capital and education: the capability approach**

In the previous paragraph, we presented the line of thought which considers human capital as an investment. This perspective sees human capital as the sum of individuals' attributes that are productive in a specific business ecosystem, while education consists of investment with private returns. This thinking follows the so-called Productive Approach, according to which “*educational outcomes are given by technical combinations of educational inputs*”. (Lanzi, 2007: p. 425) The Productive Approach focuses on the private and individualistic features of the education process. The single and personal characteristics are much more relevant compared to the social benefits of human capital development.

In his study “*Capabilities, human capital and education*”, Lanzi (2007) identify another way of thinking: the Capability Approach. It is a “*broad normative framework for the evaluation and assessment of individual well-being and social arrangements, the design of policies, and proposals about social change in society*”. (Robeyns, 2005: p. 94). This perspective was introduced by the economist and philosopher Sen (1999) and recently expanded by Nussbaum (2003). Their view of education is more open and related to people's freedom. The Capability Approach believes in the many possibilities' human beings have they can decide to do what they want and be the person they want to be. (Robeyns, 2005: p. 95) This comprehensive interpretation of education recognizes human productivity as a means of human development, not its only scope and outcome. (Lanzi, 2007: p. 425)

The Capability Approach is the perspective that our discussion will adopt in investigating



the relationship between human development and education because of the overarching frame of reference and the social aspect of human development. Furthermore, this approach reinforces the conceptualization of human capital as the sum of know-how, education, work-related competencies, and psychometric assessments. (Namasivayam and Denizci: 2006, p. 382)

Regarding our discussion, we will consider human capital as the collection of KSC that characterizes each person and education as the process through which individuals can be introduced to these tools and acquire them.

## **COMPETENCE**

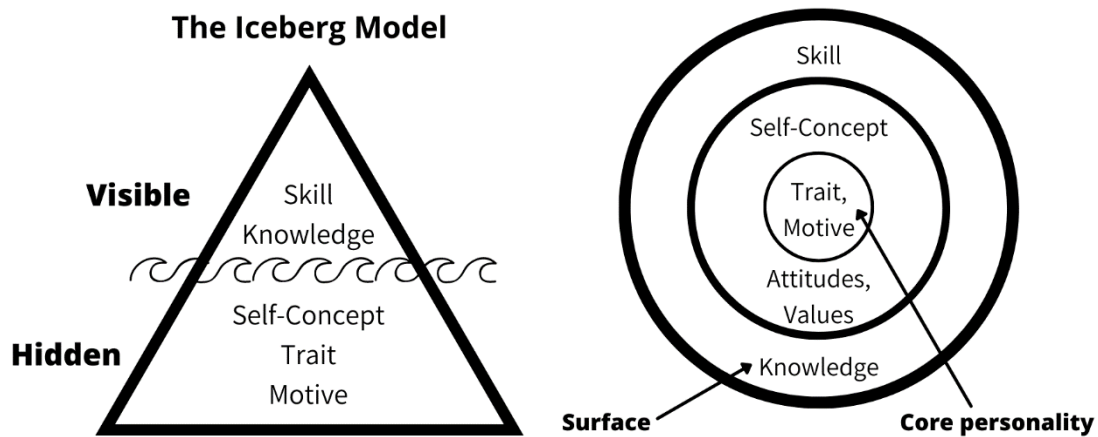
### **General meaning**

In this paragraph, we investigate the meaning and role of the concept of competence and we will assume that the terms competence and competency are interchangeable regarding their meaning, value, and purpose. (For further details, see the research of Salman et al., 2020, and related Table 3 and Table 4).

The conceptualization of competencies by Spencer and Spencer (1993) defines them from a psychological perspective. A competency is “*an underlying characteristic of an individual that is causally related to criterion-referenced effective and/or superior performance in a job situation*”. (pp. 9-11) Spencer and Spencer affirmed that competency is able to predict people behavior (causally related) and that it can codify the level of performance of the specific action (criterion-referenced effective and/or superior performance). The attribute “*underlying characteristic*” is specific to the interpretation of competency because the latter is part of the individual personality of people and it explains how people live, operate, and think in different circumstances. According to Spencer and Spencer (1993), the salient characteristics of individuals also called competencies, are five and subdivided into two main groups:

- Hidden competencies which include motives, traits, and self-concept.
- Visible competencies that comprehend knowledge and skill.

The representation of this framework is provided by The Iceberg Model of Competency, illustrated in Figure 2.



**Figure 2:** Central and surface competencies. (Spencer and Spencer, 1993: p. 11)

The Iceberg Model of Competency underlines the distinction between visible (tip of the iceberg) and hidden (underwater part) aspects, similarly to the concentric centers on the right side of Figure 2. The latter representation explains the relation between visible and hidden aspects with their counterparts: namely, surface and core personality. The second includes traits, motives, attitudes, values and self-concept and it is at the center of the figure: hence, it is deeper and difficult to develop. On the opposite side, the surface, covering the surrounding part, includes knowledge and skill, which are easier to develop and individuate. (Spencer and Spencer, 1993) From the authors' contribution, we can conclude that competence incorporates the two pillars of knowledge and skill.

### **Competence and education**

The role of competence in the learning systems and programs gained importance in the early 1900s thanks to John Dewey who, together with other scholars, provided the first basis for the shift from standardization to competency education. The review of the historical precedents of competency education by Le, Wolfe and Steinberg (2014) present evident explanations of how the way of thinking education has changed in the past century. (For further details about the authors that incentivized this change see the table on page 11).

The use of competency-based education (CBE) has been defined as “an outcome-based approach to education” which includes ways of instruction and evaluation methods to measure students' mastery of learning assessing their knowledge, attitudes, values, skills,

and behaviors. This operational definition has been elaborated by Gervais (2016: p. 99) after having reviewed many documents, authors opinion and education programs. This type of educational model is more student-centered and its three basic elements are mastery, pacing and instruction. These pillars assure customization, active participation, multiple opportunities, and real assessment through identification of acquired skills and knowledge. (Le, Wolfe and Steinberg, 2014: p. 4)

Following this competency-based approach, the school culture will focus on the idea that individuals have many possibilities of learning (given the new communication technologies and sources of information), not only through academic courses but also in the workplace, living with their families and, in general, thanks for being part of a community. Hence, education has to pay attention to students' needs and styles to offer the best solution and satisfy people's specific necessities. (Gervais, 2016: p. 102)

In 2009, Mulder et al. investigated the role of competence in higher education and they define competence as the aggregation of knowledge, skills, and attitudes necessary for *“task performance and problem-solving and for being able to function effectively in a certain profession, organization, job, role and situation”*. (p. 757) Another time, the key concepts of knowledge, skill and attitudes are mentioned to define competence significance. Moreover, as competency-based education assumes, competencies are attained with attention to the outcomes: students choose to learn and they decide how to do it in the function of the results they can obtain, to cover a specific job position or generally to be able to perform particular tasks.

In conclusion, we consider competence as the concept that comprehends the personality characteristics, knowledge, and skills of an individual and it will be defined as a sort of “umbrella” concept under which we can collocate knowledge and skill. These two central learning outcomes will be discussed individually in the next two paragraphs.

## **KNOWLEDGE**

### **General meaning**

The first element of the concept of competence we want to discuss is knowledge. The digital revolution is influencing how learning is being acquired and shared due to the evolution of communication technologies and the myriad of sources of information and for these reasons the interest in knowledge has been enlarged rapidly.

Scholars that belong to the field of cognition and literacy consider knowledge as the amount of information, skills, experiences, beliefs, and memories an individual owns. (Alexander et al., 1991: p. 317) On the contrary, in the field of epistemology knowledge refers to “*justified true beliefs and is reserved for universal, or absolute, truths*”. In their studies, Alexander et al. reviewed the psychological literature and provided their interpretation of knowledge: they gave it a broader meaning compared to the other literature, encompassing what people know and think.

Concluding, Topic 1 considers knowledge as the sum of principles and facts people acquire during their learning process and that they can use and tailor according to the situation at hand.

### **Types of knowledge**

In their study about “*Types and qualities of knowledge*”, De Jong and Ferguson-Hessler (1996) address knowledge from an epistemological point of view. This means investigating the topic with a specific focus on the function that competence has in completing a task and it implies different categorizations of knowledge for different tasks. Focusing on the problem-solving sphere, the authors’ contribution individuates four types of knowledge:

- Situational knowledge, as the name suggests, is typical of specific domains and it is useful to define the problem at hand lifting to subsequent use of the other types of knowledge.
- Conceptual knowledge concerns principles, facts and concepts and it is a sort of additional information that is useful to find a solution to the problem.
- Procedural knowledge helps to move from one step of the problem to the successive and it contains actions that are valid in a specific domain. This type of knowledge relates to “*knowing how*” and it is usually contrasted to the declarative knowledge that concerns “*knowing what*”. The first “*is more likely than declarative knowledge to be tacit-referring to actions we can perform without being able to fully explain*”. (Alic, 1997: p. 10)
- Strategic knowledge is the ability to organize what to do and in which order, this type of knowledge is the only one that can be applied to many domains, compared to the previous ones that are domain-specific. (De Jong and Ferguson-Hessler,

1996: pp. 106-107)

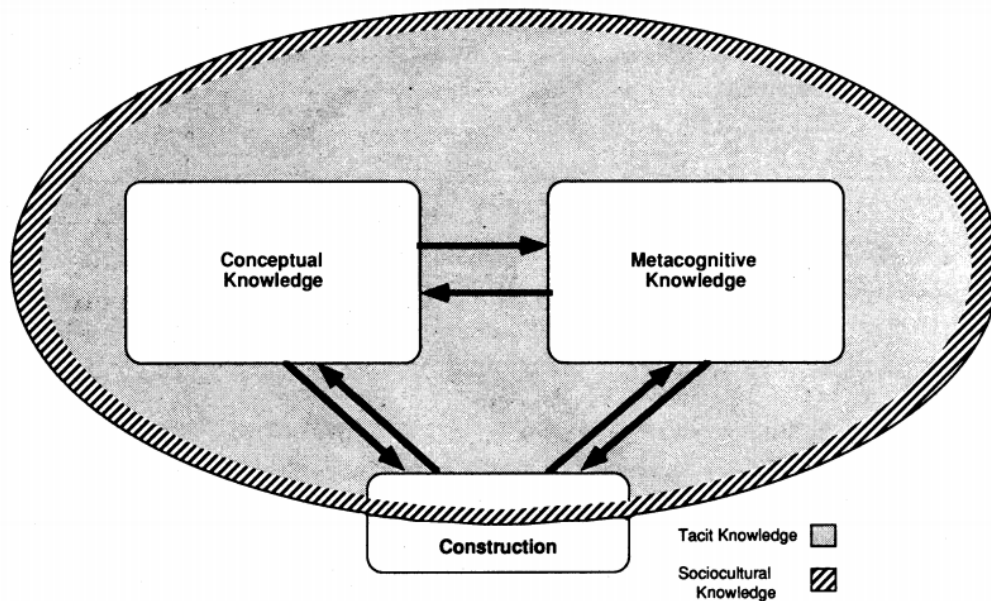
These four types of knowledge are characterized by many properties that the authors define as “*qualities of knowledge*” and are five:

- The level that defines surface or deep knowledge depending on the level in which knowledge has been elaborated and stored by the individual through assumed codes and procedures.
- The structure permits identifying the presence of isolated elements or structured knowledge. The more the knowledge is organized the more it is simple to recall and apply it.
- The automation features identify automated or non-automated knowledge. Considering any kind of discipline, people with expertise act without thinking about the procedure and the specific movements or thoughts they have to do because the repetition of the process many times makes them unconscious and fluid. It is the opposite situation of the actions performed by beginners who have to follow specific methods and pay high attention to every single move.
- The modality leads to verbal or pictorial knowledge that can be distinguished depending on how information is stored.
- The generality characterizes general or domain-specific knowledge: as the names suggest, the first can be applied in several circumstances, while the second is useful only in a specific context. (For concrete examples of these types of knowledge see Table 1 on page 111, De Jong and Ferguson-Hessler, 1996)

The authors provided a clear and useful classification of knowledge suggesting their operational view, but there exists another dichotomy within the conceptualization of knowledge that will be fully discussed in the following paragraph.

### *Tacit and explicit knowledge*

Alexander et al. (1991: p. 333) conceive “*prior knowledge*” as the sum of what an individual knows and they represent their finding through the following conceptual framework.



**Figure 3:** Prior knowledge. (Alexander et al., 1991: p. 333)

Figure 3 illustrates the components of prior knowledge in which the two principal elements of conceptual and metacognitive knowledge interact and are part of the explicit knowledge of a person's understanding. They are explicit because they are involved in the decision process and available to consciousness. The block on the right represents the conceptual knowledge that is the "individual's knowledge of ideas, or concepts" and it can be further subdivided into content and discourse knowledge. (p. 326) On the left, we have the block of the metacognitive knowledge that Flavell (1987: p. 21) defines as "the part of one's acquired world knowledge that has to do with cognitive (or perhaps better, psychological) matters" and individuates three subcategories: person, task, and strategy variables.

The space outside explicit knowledge is covered by the tacit or implicit one: it is broader, comprehensive and it touches many types of other knowledge. The relation between explicit and tacit knowledge is very dynamic and it consists of moving from one state to the other. Hence, within the person's sphere of understanding, we can find both types of knowledge depending on the degree of consciousness of the thinking or acting process. Alexander et al. (1991: p. 325) explain that something that was thought by the individual, and hence part of his explicit knowledge, can "disappear into the subconscious through loss of importance, lack of interest, personal crisis, or some other factor". So, the information moves to a more implicit and unrealized state, but it is not lost because it can affect future actions and thoughts.

The last element of the framework is the surrounding border defined as sociocultural knowledge, which represents a sort of filter through which each individual sees and perceives the world. This is constituted by the tacit background of the person made by beliefs and values that can vary as many as are the influences by the society, the family or in general by past experiences. (Alexander et al., 1991: p. 325)

### **Knowledge and education**

At the Lisbon Summit of March 2000, the European Union defined a very ambitious goal: make Europe the most competitive and dynamic knowledge-based economy in the world. The knowledge economy bases its success on the creation of knowledge and information and in the consequent dissemination of such knowledge towards as many as possible people and companies. (Schleicher, 2006: p. 2) Education plays a crucial role in attaining this goal and for this reason, it has taken the central place in the most important discussions among international organizations and governments. Learning and teaching processes have to be tailored to the new incoming necessities also meeting the final labour market demand.

To make Europe a knowledge-based economy its population must belong to a knowledge-based society, characterized by higher levels of information production, sharing and consolidation. These objectives are feasible only if every citizen can access such information: lifelong learning and the possibility to receive high-quality education and training is a powerful way of redistributing wealth in a society. (European Commission, 2017: p. 16)

*“The norms, values, attitudes, ethics, and knowledge that tertiary institutions can impart to students constitute the social capital necessary to construct healthy civil societies and socially cohesive cultures”.* (World Bank, 2002: p. 23). Much higher attention is being put on the content of educational systems compared to their structure. All levels of education should be potentiated to provide the right degree of information and KSC to all students. It is important that education, as the fundamental enabler of the knowledge economy, has open access to all young people during their entire life because well-educated and skilled people are the protagonists for creating, sharing, disseminating, and using knowledge effectively. (Hendarman and Tjakraatmadja, 2012: p. 36)

## **SKILL**

### **General meaning**

The third component of competence is skill, together with knowledge and personal characteristics. One of the first categorizations of skill goes back to 1967. Fitts and Posner thought that man's abilities depend on the context, defined as the place and situation in which someone is born or is living (Fitts and Posner define them as "*spatial and temporal factors*", p. 2). These factors highly affect how the person will be educated, in terms of culture and schools, but also the kind of job he does or will do. All these factors influence the development and acquisition of specific skills because "*the richness and diversity of human culture are based on the ability to flexibly acquire a wide range of skills, and this played a critical role in human evolution*". (Christensen, 2019: p. 1)

Fitts and Posner (1967: p. 2) define skilled performance as an organized sequence of activities with a specific purpose to reach ("*goal-directed*"). The latter can be explicit or not: people act to obtain a specific result, for example, to kick a ball to win a football match, or they can act without being aware of it, such as breathing to survive. The abilities that one develops during this sequence of activities depend on the difficulty of the action, the frequency of conduct and the necessity of the outcome.

More recently, in 2011, Kechagias (p. 31) provided his interpretation of the concept affirming that skills are capable of being learned and developed, but they are not stable characteristics because they depend on the particular contextual or situational conditions.

### **Types of skills**

#### *Universal and learned skills*

Fitts and Posner (1967) proposed one of the first categorizations of skills depending on their source: skills are defined as universal skills if they are innate and come from basic human functions or learned skills if they need to be learnt.

The first typology involves activities like breathing, digesting, and coughing which are characterized by a sort of reflexivity, meaning that they are "*inherent in the genetic structure of man*" and hence the learning process comes later. (Fitts and Posner, 1967: p. 3)



The second group regards learned skills and, as the name suggests, they come from a learning process that the person has to go through to acquire them. This category is divided into two classes:

- perceptual motor skills which comprehend all abilities related to movement and reaction to the environment's objects; they can be subdivided into three more detailed categories:
  - gross bodily skills: maintenance of position and locomotion.
  - manipulated skills.
  - perceptual skills: estimation of speed and distance, perception of spatial relationship, the recognition of a pattern of sounds.
- language skills comprehend daily communication activities, problem solving and mathematics. Perceptual skills are necessary for the development of these abilities. (Fitts and Posner, 1967: p. 4)

The words of Fitts and Posner present skills as something multifaceted and complex: they are not easily defined and the categories in which they are inserted usually overlap. Nevertheless, they set a fertile ground for the following research.

#### *Firm-specific and transferable skills*

Another distinction worth to be mentioned is the one between transferable and firm-specific skills. As the name suggests, transferable skills are the ones easily operable in different kinds of contexts without losing productivity. For this characteristic, they have been defined also as general or basic skills because they "*refer to the threshold level of cognitive skills needed for getting any job and for acquiring further skills*" (Green, 2011: p.19).

On the contrary, firm-specific skills are typical of one or a few types of domains. They are not transferable at all; indeed, these abilities are acquired within a specific activity and most of the time they remain within it because of their high specificity and uselessness in other sectors. Therefore, there will be "*as many occupation-specific skills domains as there are occupations*" (Green, 2011: p. 18).

Within this dichotomy, it is commonly argued that in addition to obtaining specific technical skills, people are increasingly required to develop a broad range of what is variously termed "*generic, transferable or employability*" skills (OECD, 2011: p. 14). As we

can see, there are many terms to define these general skills and, above all, they are also highly required in the actual business context.

The term transferable skill is more used than generic or basic skills when talking about the application of skills across different social contexts. Some examples of these types of skills are interpersonal communication, management skills and collaborative group working skills. (Bridges, 1993: p. 45)

### *Hard and soft skills*

Creating knowledge relates to the education and innovation system, where the latter consists of institutions, rules and procedures that influence the acquisition, creation and use of knowledge. Both these systems require hard and soft skills. (Hendarman and Tjakraatmadja, 2012: p. 36)

In this paragraph, we introduce one of the most frequent and actual distinctions of skills concerning hard and soft skills. The use and abuse of these terms make their identification and comprehension more confusing.

The first element to be clarified is that soft skills are also called transferable or generic skills because they refer to a range of general education skills that are neither domain nor subject-specific. Given their broad applicability, some examples of these types of skills are communication skills, written skills, interpersonal skills, critical, problem-solving, judgement and analytical skills. It has to be considered that they are transferable to some extent because they depend at least on the context in which they are acquired and remain. (Ballantine and McCourt Larres, 2004: p. 171) Another definition of soft skills is provided by Kechagias (2011: p. 33) who defines them as *“intra- and inter-personal (socio-emotional) skills, essential for personal development, social participation and workplace success”*.

While soft skills are interpersonal and broadly applicable, hard skills are about people's skills set and ability to perform a specific task or activity. (Hendarman and Tjakraatmadja, 2012: p. 37)

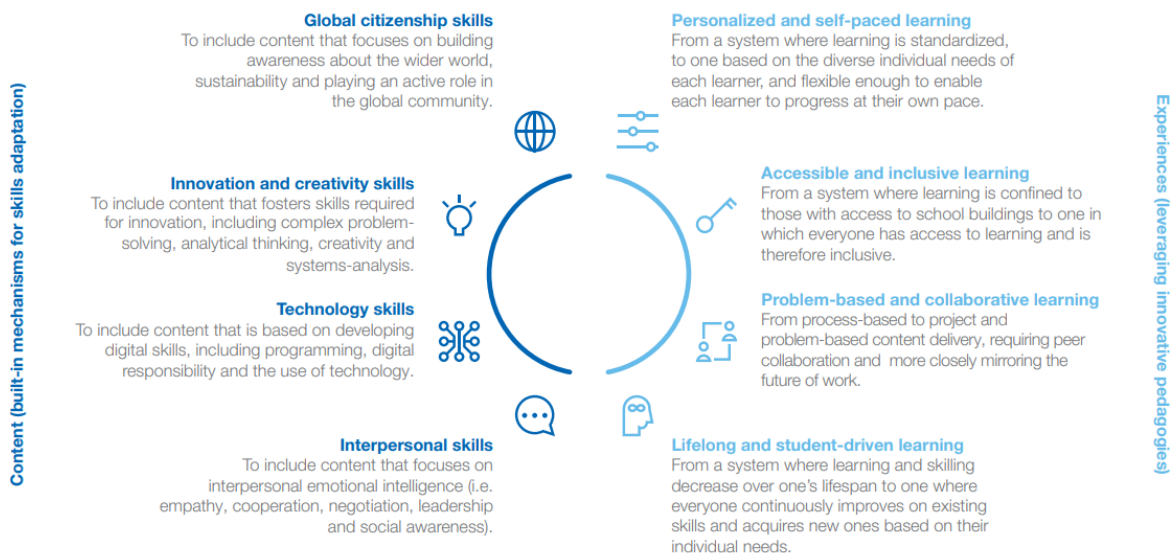
Once having a clearer understanding of the highly required soft or generic skills, we can see how their teaching and sharing work. In general, to foster the development of generic skills you have to identify and promote their importance, to develop mechanisms for communicating their scope using authentic experiences and team-based and integrated approaches. (For further information about generic skills fostering in training

organizations and workplace see Box I in NCVET, 2003, page 4)

## Skills and education for the future

In the past, those responsible for education, like professors, were presumed to transmit information to students and to create knowledge through their research. In this context, the skill was considered a more technical aspect difficult to be communicated and comprehended. (Alic, 1997) On the contrary, in the context of job disruption and technological change, education models must adapt to equip children with the KSC to enhance individuals' growth and to meet the workforce requirement. Today's schoolchildren are the citizens of the future and they will work in new job types that do not yet exist, involving higher digital and communication skills. (WEF, 2020b)

The WEF elaborated a global model called Education 4.0 Framework with the aim of helping countries, governments, and educational institutions in developing a new approach to education. It is based on the strong evidence that education is a key contributor to relative social mobility which is the social and economic status of an individual relative to their parents.



**Figure 4:** The World Economic Forum Education 4.0 Framework. (WEF, 2020b: p. 7)

Figure 4 illustrates Education 4.0 Framework: on the right side, there are four improvements to make the pedagogy (Experiences) more innovative and able to tackle the opportunities of the new technologies elaborating learning ecosystems that are

personalized and self-paced; accessible and inclusive; problem-based and collaborative; and lifelong- and student-driven. On the left side of the image, there are the four key skill sets that children should acquire through education (Learning Content) to make them prepared to become both productive and skilled employees and responsible and active citizens in society. The four categories of skills that future education programs should transmit to young people are global citizenship, innovation and creativity, technology, and interpersonal skills.

As we can notice, the four skills categories of the Education 4.0 Framework are closely related to the economic and social environment in which future generations have to operate. Similar purposes have Life Skills Education enabling people to face new challenges and unpredictable circumstances, acquiring, and developing “*psycho-social skills*” to approach life in the best way possible. Life Skills Education are defined by UNICEF (2015: p. 9) as a “*structured program of needs- and outcomes-based participatory learning*”. In 1993, the World Health Organization (WHO: p. 2) described them as the abilities that provide individuals with the capacity of facing daily life challenges through adaptive and positive behavior. This type of skills depends on the culture and context in which they are individuated, even if WHO has established a “*core set of skills*” composed of ten life skills grouped in three main categories:

- Thinking skills which are decision making, problem-solving, creative thinking, critical thinking.
- Social skills which include effective communication and interpersonal relationship skills.
- Emotional skills are self-awareness, empathy, coping with emotions and coping with stress. (Prajapati et al., 2017: p. 3; UNICEF, 2015: p. 9)

Prajapati et al. (2017), in their work “*Significance of Life Skills Education*”, reviewed many documents and authors' contributions demonstrating that life skills education to students has many advantages. In particular, these skills should be introduced in the institutional education programs of high schools helping young people to cope with their life challenges and make them aware of their possibilities, both as individuals and citizens.

The importance of Life skill Education and Education 4.0 Framework are very important attempts in guiding the further development of education all over the world and in providing young people with the right set of tools to face different contexts and circumstances.

## CONSIDERATIONS ON TOPIC 1

Topic 1 permitted us to investigate the principal learning outcomes from an educational sciences point of view. The table presented in Figure 5 is an attempt to summarize and categorize the existing knowledge about KSC from the perspective of Topic 1. The table includes the defining characteristics of the principal concepts of competence, knowledge and skill emerging from the SLR performed in this chapter.

| TOPIC 1           | MEANING   |
|-------------------|---|
| <b>KNOWLEDGE</b>  | Knowledge is the sum of principles and facts people acquire during their learning process and that they can use and tailor according to the situation at hand. Knowledge is catalogued in typologies according to its characteristics of automation, generality and level.                                    |
| <b>SKILL</b>      | Skills are an organized sequence of activities with a specific purpose that depends on the situation. They are not stable characteristics but they can be learned, developed and lost during life. The typologies depend on the specificity, transferability and the process through which they are acquired. |
| <b>COMPETENCE</b> | Competence is a specific characteristic of the person constituted by skill and knowledge but also personal traits, values and attitudes. It predicts people's behaviour in terms of performance and context of action, from the job profession to the general role or situation.                              |

**Figure 5:** Topic 1: KSC's meaning. (Personal elaboration)

We define knowledge as the sum of principles and facts people acquire during their learning process and that they can use and tailor according to the situation at hand. Knowledge can be catalogued in typologies according to its characteristics of automation, generality, and level.

Skills are defined as an organized sequence of activities with a specific purpose that depends on the situation. They are not stable characteristics but they can be learned, developed, and lost during life. The skill typologies depend on the specificity, transferability, and the process through which they are acquired.

Finally, there is competence. It includes the previous two concepts together with personal traits, values, and attitudes. It predicts people's behavior in terms of performance and

context of action, from the job profession to the general role or situation.

These three concepts are closely related because each concept is an important element for the definition of the other: competence could not be fully comprehended without knowing the meaning and value of skill and knowledge and vice versa. The information elaborated in Figure 5 is very important because it will be analyzed and compared with the final considerations and definitions emerging from the SLR of the next chapters.

## **CHAPTER 2: PERSPECTIVE OF HUMAN RESOURCE MANAGEMENT**

### **INTRODUCTION**

In this chapter, we take the perspective of human resource management (Topic 2) as the guiding point of view: it is useful to understand the logic and dynamics behind workers management to better understand the meaning and role of human capital and its elements.

In the actual environment, human resources and their KSC are rising in importance due to their precious characteristics of inimitability, adaptability, and innovation. For these reasons, Chapter 2 starts with the description of sustained competitive advantage as the condition that ensures a company's competitiveness. Hence, it focuses on the resource-based view of the organization and the importance of VRIN resources, but especially of the dynamic capabilities approach, the one that fits better the technological circumstances of the dynamic business environment. Then, intangible assets are identified as a primary resource for adapting to the changing context with particular attention to intellectual and human capital or, in this chapter, human resources.

The discussion continues with the SLR of the concepts of KSC, investigating which are their possible classifications and which could be the implications of embodying high qualified human resources in the firm.

### **SUSTAINED COMPETITIVE ADVANTAGE AND INTANGIBLE ASSETS**

Teece (2000: p. 30) affirmed that knowledge, competence, and related intangibles are the key drivers of competitive advantage because they are the main basis of differentiation. Sustainable strategies, knowledge and innovation enhance adaptive management and they are supposed to assure competitiveness to the organization in the long run. To find evidence of the correlation between intangibles and competitiveness, we have first to explain the difference between competitive advantage and sustained competitive advantage.

Barney (1991: p. 102) defines competitive advantage as the situation in which *"a firm is implementing a value-creating strategy not simultaneously being implemented by any*

*current or potential competitors*". Integration of the concept concerns sustained competitive advantage which includes that "*firms are unable to duplicate the benefits of this strategy*". (Barney, 1991: p.102) This requisite highlights the danger of duplicity and imitation by others, which can harm the possibility of being the leader and competitive in the long term. Hence, supremacy is not assured once obtained because innovation can be a double-edged sword. Innovation is a driver of sustained competitive advantage together with an inimitable strategy.

Intangibles and related knowledge-based resources, like intellectual and human capital, are necessary for adaptation to the changing economic and social environment. These assets generate a company's value and its survival in the market, so it is necessary to constantly upgrade and invest in the business.

Weatherly (2003: p. 1) identifies three asset classes that contribute to generate value for organizations:

- Financial assets that include assets such as cash and marketable securities and may also be referred to as financial capital.
- Physical assets include tangible assets like property, plant and equipment, and other furnishings.
- Intangible assets are also called intangible capital and include intellectual capital (patent formulas, product designs, and process technology, i.e., the methods that delineate the steps in a process), goodwill and human capital.

The goal of our research focuses on intellectual and human capital which are included in the third asset class. They are defined as intangible because they differ from the other two types of assets in terms of immateriality and non-monetary value.

Intangibles can be defined in many ways according to the field of study or the current of thought you consider. Intangibles have been defined as "*knowledge, skills, and aptitudes at the individual level and as databases, technology and routines at the organizational level*" by Johanson et al. (1998: p. 12). Teece (2000: p. 3) associates them with knowledge, competence and intellectual property because of their origin and value. It is evident that within intangible assets we can collate intellectual and human capital. Before focusing on them, we need to better explain the roots of sustained competitive advantage theory and its main consequences for our research.



## **The resource-based view and VRIN resources**

An innovative and inimitable strategy has been considered one element to achieve and maintain sustained competitive advantage. But another important factor that explains a business's advantage is firm resources.

The resource-based view is a theoretical framework to explain competitive advantage sources and has its focus on firm internal resources (e.g., Wernerfelt, 1984). This approach assumes that firms can be conceptualized as bundles of resources and that those resources are heterogeneously distributed across firms, with differences that persist over time (Eisenhardt and Martin, 2000: p. 1105). Resources are all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enables the firm to conceive of and implement strategies that improve its efficiency and effectiveness. (Daft, 1983)

Barney (1991: p. 101) supports this resource perspective and proposes a resource classification individuating the following groups:

- Physical capital resources (physical technology, access to raw material, plant, and equipment).
- Human capital resources (training, experience, relationships).
- Organizational capital resources (formal reporting structure, planning, controlling, and coordinating systems, relations between the company and its stakeholder).

As we can see, there are some similarities between Barney's resources classification and the assets categories defined by Weatherly (2003): specifically, physical assets and physical capital resources include the same items and human capital resources are included in the assets class of intangibles.

The resource-based view approach looks at the strengths and weaknesses of the firm from an internal and managerial point of view. The company's resources are the basis for creating and implementing effective strategies that should permit the company to obtain a sustained competitive advantage. But not all types of resources can cover this role. Barney (1991: pp.106-107) incorporates the resources to achieve sustained competitive advantage into the acronym VRIN:

- Valuable, in the sense that they exploit opportunities and/or neutralize threats in the market.
- Rare, among the firm's current and potential competition.

- Imperfectly inimitable means that these resources cannot be obtained by competitors.
- Non-substitutable, in the sense that they cannot be strategically equivalent substitutes.

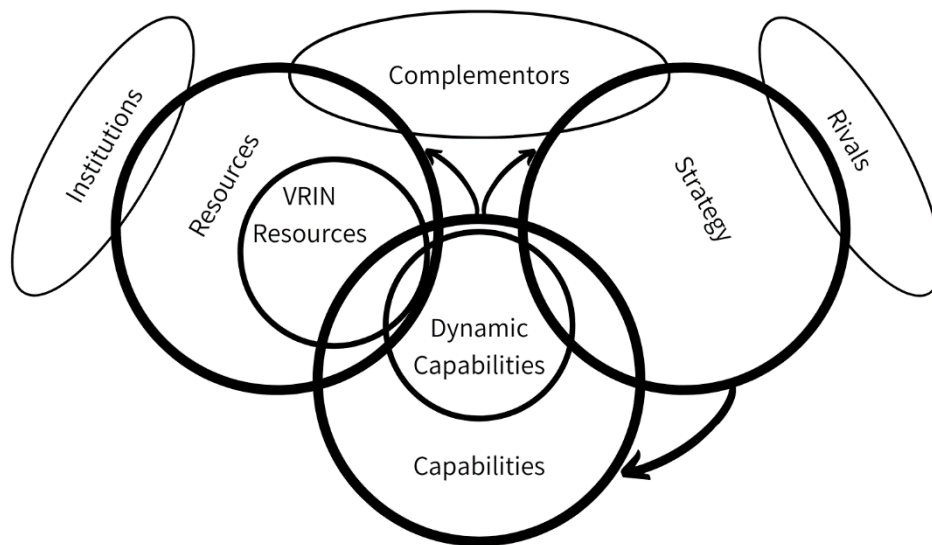
The category of intangible resources is the one that most fits the VRIN criteria, and consequently, the human capital resources do the same. Intangible assets are valuable, rare, inimitable, and non-substitutable by other companies because they are not easily tradable. Moreover, it is difficult to imitate or acquire them because of their level of tacit knowledge and poor property rights.

The more tacit the firm's productive knowledge, the harder is the imitation by its competitors. These considerations support the value of investigating knowledge-based resources like intellectual and human capital.

### **Dynamic capabilities approach**

The impact of the rapidly changing and turbulent business ecosystem led to the resource-based view's update: the external environment, in terms of opportunities and threats, has been integrated. (Teece et al., 1997: p. 510) The birth of the dynamic capabilities approach involves the rapidly changing context and it needs to introduce firms' capabilities. The special type of dynamic capabilities should be owned by companies to elaborate and manage the resources at hand generating new recombined resources and consequently new sources of sustained competitive advantage.

Figure 6 shows the comprehensive dynamic capabilities framework with the three competitive advantage drivers and their relations, namely strategy, resources, and dynamic capabilities.



NOTE: A DASHED BORDER INDICATES ELEMENTS THAT ARE EXTERNAL TO THE FIRM. ARROWS REPRESENT MAJOR INFLUENCE. VRIN =VALUABLE, RARE, IMPERFECTLY IMITABLE, AND NON-SUBSTITUTABLE

**Figure 6:** The key elements of the dynamic capabilities framework. (Teece, 2018)

Capabilities, resources, and strategy constitute a system of interdependent elements that collectively determine the competitiveness of a firm. (Teece, 2018: p. 365) This comprehensive framework includes all factors that previously have been discussed as drivers of sustained advantage establishing their equally important value and their necessary interrelation. The dynamic capability approach involves the dynamicity factor that embodies the innovation and technological change of the actual business and social environment.

#### *Ordinary and dynamic capabilities*

In this paragraph, we deepen the analysis of dynamic capabilities given their growing role and important purpose. Before defining dynamic capabilities, it is useful to present and compare them with other types of capabilities to underline the main similarities and differences. In the hierarchy, the first and lower level of capabilities is covered by the so-called ordinary or zero-level capabilities. Winter (2003: p. 992) specifies that they are the ones exercised in the stationary process of the business and, for this reason, he also calls them “*how we earn a living now capabilities*”. Many years later, Teece (2014: p. 331) affirms that ordinary capabilities can best be thought of as achieving technical efficiency

and doing things right in the core business functions of operations, administration, and governance. These last three functions are the basic operations in which the company exercises its ordinary capabilities to reach the necessary amount of effectiveness in the short term.

On the opposite side of the low order capabilities, we have the dynamic ones described by Teece (2000: p. 26) as the ability to sense and then to seize new opportunities, and to reconfigure and protect knowledge assets, competencies and complementary assets and technologies to achieve sustainable competitive advantage. The three fundamental operations are sensing (identification, development, co-development, and assessment of technological opportunities about customer needs), sizing (mobilization of resources to address needs and opportunities and capturing value from doing so) and transforming (continued renewal) (Teece, 2014: p. 332). The use of these operations tends to give value and maintain an excellent relationship with the external environment because it is from tackling opportunities and neutralizing threats that the firm can obtain benefits.

Dynamic capabilities' level within the organization depends on different factors such as the hierarchical form of management, the external environment in which it operates (in terms of sector and technological level) and the strategies adopted by the firm. Figure 7 illustrates a comparison between the two types of capabilities.

|                              | <b>Ordinary Capabilities</b>               | <b>Dynamic Capabilities</b>  |
|------------------------------|--|--|
| <b>Purpose</b>               | Technical efficiency in business functions | Achieving congruence with customer needs and with technological and business opportunities |
| <b>Mode of attainability</b> | Buy or build (learning)                    | Build (learning)   |
| <b>Tripartite schema</b>     | Operate, administrate, and govern          | Sense, size, and transform   |
| <b>Key routines</b>          | Best practices                             | Signature processes  |
| <b>Managerial emphasis</b>   | Cost control                               | Entrepreneurial asset orchestration and leadership   |
| <b>Priority</b>              | Doing things right                         | Doing the right things   |
| <b>Imitability</b>           | Relatively imitable                        | Inimitable   |
| <b>Result</b>                | Technical fitness (efficiency)             | Evolutionary fitness (innovation)  |

**Figure 7:** Differences between ordinary and dynamic capabilities. (Teece, 2014)

Focusing on the last two features (imitability and result) and remembering Barney's definition of sustained competitive advantage, companies need to develop and use dynamic capabilities because of their inimitability by competitors and the results they ensure. Dynamic capabilities being embedded in the company and evolving according to circumstances are difficult imitable and innovation generators. This "*evolutionary fitness*" is the best weapon for companies to face technological change and to obtain a sustained competitive advantage in the long term.

## **INTELLECTUAL CAPITAL**

### **General meaning**

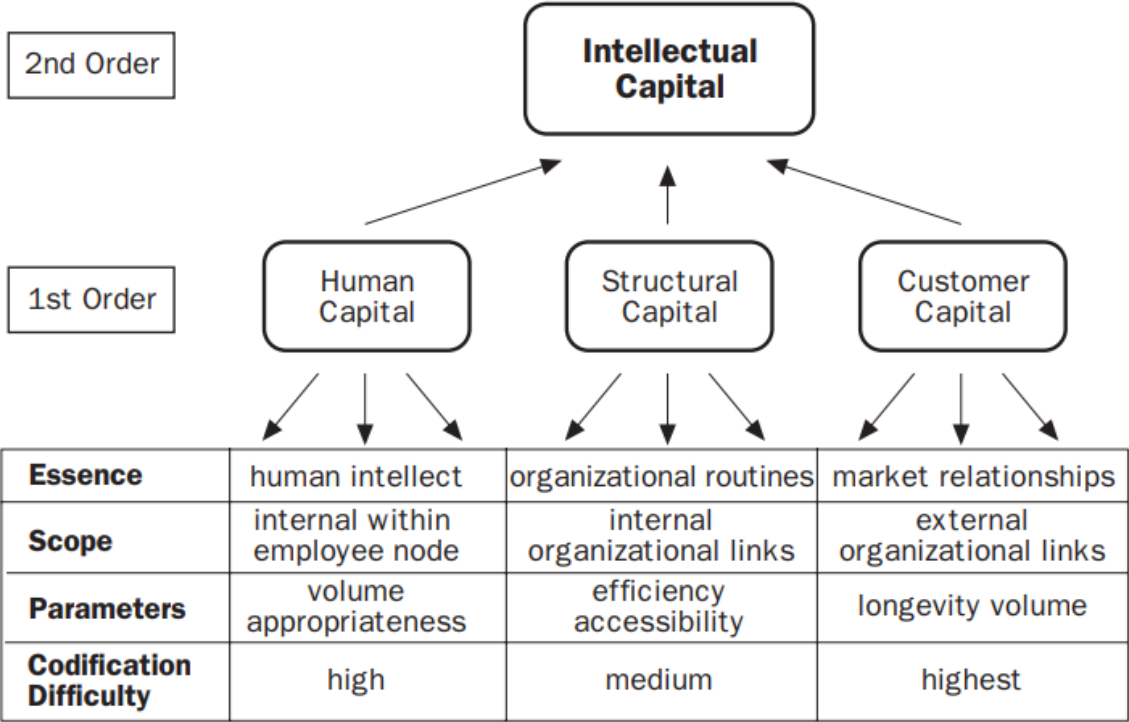
The growing attention on the ability to be competitive in the dynamic knowledge economy led to the recognition of intellectual capital as one of the main drivers for innovation and competitiveness.

Intellectual capital has been defined by Tayles et al. (2002: p. 252) as "*the total stock of human capital or knowledge-based equity that a company possesses*". Identifying and managing employees means also organizing and comprehending the value of what these workers know and can do. These latter compose the intellectual capital of the company and more specifically its human resource, whose both elements compose the intangible assets of the business.

Intellectual capital can seem very similar to the concept of human capital and used interchangeably, but there is a distinction between the two. A famous scholar that investigates the concept of intellectual capital from a managerial perspective is Nick Bontis (1998), whose studies are very clear and representative of the previous and disseminated research. Reviewing the precedent literature, Bontis (p. 67) mentioned the first author who introduced the concept of intellectual capital, John Kenneth Galbraith. In 1969, he started to think about it as more than just "intellect as pure intellect" introducing a degree of "*intellectual action*". This first definition highlights the procedural character of the term and gave birth to many theories and studies on this new valuable resource.

**Classifications of intellectual capital**

One of the first classifications of intellectual capital refers to the structure developed by Sveiby (1997: pp. 10-11), who classifies invisible assets (intangibles) by individuating three components: employee competence, internal structure, and external structure of the organization. Respectively “*the capacity to act in a variety of situations to create both tangible and intangible assets*”, “*patents, concepts, models, computers and administrative systems*” and the “*relationships with customers and suppliers...company’s reputation or image*”. Following the line of thought and the classification of Sveiby, Bontis individuates three components of intellectual capital: human, structural and customer capital. (Bontis, 1998: p. 66)



**Figure 8:** Conceptualization of intellectual capital. (Bontis, 1998: p. 66)

As synthesized in Figure 8, Bontis individuates three types of capital:

- The structural capital corresponds to the internal structure individuated by Sveiby and it consists of the organizational routines. It “*deals with the mechanisms and structures of the organization that can help support employees in their quest for optimum intellectual performance and therefore overall business performance*”.

(Bontis, 1998: p. 65)

- Customer capital (or relational capital) refers to the external structure of the Sveiby classification. It concentrates on the “*knowledge of marketing channels and customer relationships*” and refers to the organization’s potential about its intangibles or “*knowledge embedded in customers, suppliers, the government or related industry associations*”. (Bontis, 1998: p. 67)
- The third component, human capital, is the focus of our research and Bontis defined it starting from Sveiby conceptualization of employee competence. Human capital will be fully discussed in the next paragraphs.

The conceptualization represented in Figure 8 is the most diffused between the documents on intellectual capital. Scholars believe that this three-part subdivision is the most representative, even though they can use different terms to identify the components. For example, Roos et al. (1997) use the three terms human, relational and organizational capital; Dzinkowski (2000) incorporates three main components: human capital, organizational (structural) capital, and customer (or relational) capital; Stewart (1997) defined them as human structured and customer capital and Edvinsson and Malone (1997) individuate four dimensions of intellectual capital adding the innovation capital. (For detailed definitions see Table 1 that summarizes the commonalities between many authors’ intellectual capital interpretations: Cabrita, 2009, p. 234 and Garavan et al., 2001, p. 50)

Considering the management perspective, the classification by Bontis includes both internal and external factors. The human and organizational capital represents the internal part of the company, respectively concerning employees and the organization itself; while the customer or relational capital is mainly related to the external environment, involving stakeholders and the whole value chain.

Taking this intellectual capital classification for granted, now we deepen the role and value of one of the three components: the human capital.

## **HUMAN CAPITAL**

### **General meaning**

Many companies in different sectors are becoming more and more aware of the role of people. Nowadays investments to acquire and retain within the company talented

workers is evolving into a priority. Work relations, together with the enhancement of individual KSC, will increase the competitive advantage of the organization in terms of its human capital.

In the actual knowledge economy and society, organizations know that the value creation process comes from people, not only from tangible assets and mere profit. Recognizing the great importance of human capital has resulted in more dedicated protection and enhancement of this resource, pursuing sustainable development and specifically social cohesion.

During the evolution of the concept, from its early stages until the 21st century, human capital has remained one of the most important investments for the organization and a key valuable resource. Looking at the most representative interpretations, Weatherly (2003: p. 1) provides a very wide definition affirming that a company's human capital asset is the collective sum of the attributes, life experience, knowledge, inventiveness, energy, and enthusiasm that its people choose to invest in their work. The author's contribution shows that many components can be included in this comprehensive concept and their presence usually depends on the purpose and the field of the investigation. We can identify not only the most frequent elements associated with human capital but also some more pervasive factors such as energy, enthusiasm, and creativity. These three are more subjective and part of the personality of the individual, depending on the character of each of us.

In 2001, Garavan affirmed that from the individual perspective human capital is recognized in employability, performance, and career development, whereas from an organization perspective in investment, ownership, skills, and knowledge management. Similarly, Dzinkowski (2000) defines human capital as employees' know-how, capabilities, skills, and expertise.

Human capital has been recently defined by Goldin (2016: p. 22) as the stock of productive skills, talents, health and expertise of the labour force, just as physical capital is the stock of plants, equipment, machines, and tools. Human capital's components generate value and they can be both objective and subjective. The first type includes the worker's KSC, while the subjective factors are experience, talents, values, and creativity that are personal traits of the employee.



## **Human resource management**

Human capital or human resources (HR) are of crucial interest in human resource management (HRM) studies because their accumulation is the outcome of human resource development (HRD) strategies. Organizations and individuals invest in HRD to build and maintain human capital in the future and to retain this resource in the present. (Garavan et al., 2001: p. 48)

To fully comprehend Topic 2, we have to examine the concepts just mentioned (HR, HRM...). Boudreau (1996) writes that human resources are part of a system in which they interact with other functions and are influenced by many external factors. His model presents three fundamental elements: environment, organization, and human resources. The first provides context, opportunities, and constraints; the second combines many resources to survive, grow and create value; the third, human resources, represents the employees of the organization and the results they create through employment. (Boudreau, 1996: p. 14)

In HRM strategies KSC are both characterizing elements of job occupations and the criteria for choosing between new workers. The required KSC types and levels play a crucial role in the value creation process, therefore HRM and the choice of future workers in terms of KSC is one of the most important functions of the firm.

Boudreau (1996: p. 5) stated that HRM strategies help to identify which workers are a source of innovation, to diffuse learning and knowledge within them and to make every aspect of the organization a learning opportunity.

## **COMPETENCE**

### **General meaning**

*“Employee competence is the treasure as well as a critical element for sustainable development and effective organizational performance”*. With these words, Salman et al. (2020: p. 719) clarify the struggles and opportunities in managing the multifaceted concept of competence and comprehending its role in the value creation process. In reviewing many previous studies, they discover that competence plays a significant role in improving the performance of employees affecting the achievement of organizational goals. From this evidence, Salman et al. believe that companies should use a competence approach in managing their business and in particular the workers that permit it.

Both for Topic 1 and 2 the concept of competence has not a commonly shared and defined definition. Efforts in defining this concept are several and to comprehend the role of competencies in the HRM field we discuss some interpretations.

The first we mention is the one by Sveiby (1997: p. 10): he identifies employee competence as one of the three components of intellectual capital involving the capacity to act (performing a job or task) in different circumstances to create tangible and intangible assets. Employee competence was also the starting point for the development of Bontis' human capital interpretation. According to Sveiby, employee competencies can be considered a firm's intangible assets because of the leading role of workers within it. Sveiby highlights the importance of employee competence from an aggregated point of view considering workers and their competencies a source of competitive advantage.

One of the many approaches through which competence has been studied is the rationalistic approach that considers competence as an attribute-based phenomenon *"constituted by a specific set of attributes such as knowledge, skills and attitudes which persons use in accomplishing their work"* (Sandberg, 2001: p.10). Bergenhenegouwen (1997: p. 30) proposes its interpretation of individual competencies as concerned with the fundamental personality characteristics of people that can perform all kinds of tasks and in different situations. Whereas Nagarajan and Prabhu (2015: p. 7) believe that competence can include a combination of knowledge, basic requirements, skills, abilities, behavior and attitude. From the analysis of the previous interpretations, we can notice that similarly to Topic 1, competence includes within its wide meaning elements that can be intrinsic to the single individual or more standardized and objectively acquired.

The difficulties in establishing a common and clear definition of competence are due both to the several fields of study that address this concept and to the different mindsets and cultures that characterize scholars depending on the country in which they live and study. Many authors concluded that it is better to provide and use a holistic approach that can comprehend the meaning and relation of many factors and characteristics, we will see this comprehensive approach in the following paragraph.

### **Holistic framework**

Delamare Le Deist and Winterton (2005) in their work "What Is Competence?" analyzed many definitions, studies and approaches from the USA, UK, France, Germany and Austria to clarify this *"fuzzy concept"*, as they defined competence.

The graphic in Figure 9 illustrates the typologies of competence that the authors identify. In this overarching framework, we can individuate two main categories positioned in the axis: the occupational-personal and the conceptual-operational competence category. The first regards the field in which the competencies are applied, so they can be occupational if they are necessary for working or personal if they refer to individual effectiveness. On the other hand, we have the distinction between conceptual competence, which regards the intellectual sphere, and operational competence which is more related to the practical sphere. (Delamare Le Deist and Winterton, 2005: p. 39)

This framework was first created by Delamare Le Deist and Winterton and refined one year later with the help of Stringfellow (Delamare Le Deist, Winterton and Stringfellow, 2006: p. 60). The final version is the one illustrated in Figure 9 and it is a unified matrix that also incorporates the pillar elements of knowledge, skill, attitudes, together with behaviors and learning.

|                    |  |   |
|--------------------|--|---|
| <i>conceptual</i>  | <i>occupational</i><br>cognitive competence<br>(knowledge) | <i>personal</i><br>meta-competence<br>(facilitating learning) |
| <i>operational</i> | functional<br>competence<br>(skills)                       | social competence<br>(attitudes and<br>behaviours)            |

**Figure 9:** Unified typology of KSC. (Delamare Le Deist, Winterton and Stringfellow, 2006: p. 60)

Going into the boxes created by the matrix, we can identify four types of competencies:

- cognitive competence (occupational-conceptual) that captures knowledge and understanding and it is the ability to learn and to perform analytical thinking, planning and problem-solving (Siriwaiprapan, 2003: p. 129).
- functional competence (occupational-operational) captures skills and it is based on the performance of the action. It is the ability to perform job tasks to the standard expected in employment (Salman et al., 2020: p. 728).
- social competence (personal-operational) captures behavioral and attitudinal competencies pushing the attention on the individual's characteristics. "*Social interaction competence includes skills in networking (making connections);*

*maintaining interpersonal relations and enjoying the benefits of peer relations”* (Siriwaiprapan, 2003: p.128).

- meta competence (personal-conceptual) facilitates the acquisition of the other competencies. (Delamare Le Deist and Winterton, 2005: p.39). *“Meta-competencies either assist in developing other competencies (e.g., self-development) or are capable of enhancing or mediating competence in any or all of the component categories (e.g., creativity)”*. (Cheetham and Chivers, 1996: p. 24) Being so generic they are applicable in different contexts and occupations.

A final consideration on the matrix concerns the possibility of defining the categories of competencies on the axes as the sum of the ones inside the internal boxes. For example, operational competence is given by the sum of functional and social competencies or occupational competence comes from adding cognitive and functional competencies, and so on...

### Hard and soft competences

A result similar to the matrix created by Delamare Le Deist and Winterton has been found by Salman et al. (2020) which is illustrated in Figure 10.

| <b>Hard competence</b>   | <b>Soft competence</b>   |
|--|--|
| <b>Knowledge-related competence</b><br>1. Cognitive competence<br>2. Conceptual competence                     | <b>Behavior-related competence</b><br>1. Social/behavioral competence<br>2. Operational competence<br>3. Emotional competence<br>4. Cross-cultural competence<br>5. Team competence<br>6. Communicative competence |
| <b>Skill-related competence</b><br>1. Functional competence<br>2. Occupational competence<br>3. Job competence | <b>Self-Actualization-Related Competence</b><br>1. Meta Competence<br>2. Ethical Competence<br>3. Self-Competence<br>4. Change Competence<br>5. Leadership Competence  |

**Figure 10:** Classification framework of competence: hard and soft competence. (Salman et al., 2020: p. 722)

They provide the same collocation for the previous four categories of competencies: cognitive competence as knowledge-related, functional competence concerning skills, social competence as behavioral-related and meta competence as self-actualization-related. The further improvement of the authors concerns the addition of more types of competencies: language/communicative competence, cross-cultural competence, ethical competence, self-competence, team competence, change competence, leadership competence, emotional competence, and job competence. (Salman et al., 2020: pp. 729-730)

The most relevant difference with Delamare Le Deist and Winterton (2005) holistic framework is that this detailed matrix subdivided the competencies into two important categories: hard and soft competencies. Therefore, knowledge and skill-related competencies are considered as hard ones, while behavioral and self-actualization-related competencies are classified as soft. The distinction between the two types of competencies is very similar to the one between hard and soft skills, explained in the previous chapter. The hard competencies are domain-specific and more technical, whereas the soft skills are broader and personal.

### **Core competence and core capability**

According to Topic 1 competence and capability have the same meaning, on the opposite, Topic 2 leads to further investigation of the terms. Vincent (2008: p. 1) provides his interpretation of both the concepts: capability is a *“feature, faculty or process that can be developed or improved...through which individual competencies can be applied and exploited”*, whereas competence is the *“quality or state of being functionally adequate or having sufficient knowledge, strength, and skill...another word for an individual’s know-how or skill”*. Following the author’s contribution, we can derive one reason that justifies our attention on competence: capabilities are the basis for applying and exploiting the application and exploitation of competencies, so it is worth studying and highlighting the outcome of the process.

Sometimes people erroneously treat the two terms as synonyms even if there are profound differences between the two. This error happens more frequently in the case of core competence and core capabilities. Stalk, Evans, and Shulman (1992: p. 65), considering the general value chain, state that core competence emphasizes technological and production expertise at specific points along the chain, whereas capabilities are more

broadly based, encompassing it. Prahalad and Hamel (1990: p. 81) defines core competencies as *“the collective learning in the organization, especially how to coordinate diverse production skills and integrate multiple streams of technologies”*. Leonard-Barton (1992: p. 113), from a knowledge-based view, defines core capabilities as the knowledge set that ensures competitive advantage and this set is composed of four dimensions: employee knowledge and skills, technical systems, managerial systems and values and norms. Hase and Davis (1999: p. 2) identifies the principal difference between core competencies and capabilities affirming that *“in comparison to competency, which involves the acquisition of knowledge and skills, the capability is a holistic attribute”*.

The table in Figure 11, summarizes Nagarajan and Prabhu (2015: p. 9) ideas about the two concepts which are consistent with the other scholars' proposals and it summarizes differences and similarities.

| <b>Competency</b>  | <b>Capability</b>                                    |
|--|--|
| Knowledge relevant to the workplace                        | Theoretical knowledge                                |
| Skills relevant to the workplace                           | Skills underpinned by theoretical knowledge          |
| Application may be limited to defined set of circumstances | Can be applied in complex and changing circumstances |
| Standard set for performance                               | May not have defined standard                        |
| Standard set by regulatory process/workplace               | Standard may be set by profession or external body   |

**Figure 11:** Competence vs Capability. (Nagarajan and Prabhu, 2015: p. 9)

Competencies are knowledge and skills relevant to the workplace, while capability is a piece of more theoretical knowledge and consequently broadly applicable. The domain-specific application of competence is interesting for the HRM perspective analysis of this chapter and it is justified by the three important characteristics of core competencies:

- They permit the firm’s access to several markets.
- They contribute to the perceived customer benefits of the end product.
- They are difficult to imitate from competitors. (Prahalad and Hamel, 1990: p. 83)

These features make core competencies a very powerful and valuable resource, that is the

reason why businesses invest and strengthen them to obtain higher efficiency and economic superiority.

## **KNOWLEDGE**

### **General meaning**

The knowledge concept is one of the most important components of intellectual capital. In an uncertain and turbulent business ecosystem, where *“markets shift, technologies proliferate, competitors multiply, and products become obsolete almost overnight, successful companies are those that consistently create new knowledge, disseminate it widely throughout the organization, and quickly embody it in new technologies and products”* (Nonaka, 1991: p. 162). These activities characterize the so-called knowledge-creating companies: their intensive use of information and communication technologies (ICT), knowledge, innovation and human capital make them able to survive in the actual dynamic context.

Knowledge is one of the main drivers of the firm's competitiveness and this is the reason why a lot of sectors are betting on this winning resource, especially the ones related to *“semiconductors, computers, electronics and communications equipment and services”* (OECD, 2000: p. 9). In the 21st-century business ecosystem, companies' competitive advantage does not depend only on market position, but on the difficulty to replicate knowledge assets and how they are deployed. (Teece, 2000: p. 12)

*“Knowledge is the base-level component of human capital and without question an organizational asset”* (Herling and Provo, 2000: p. 2). Its importance is rising within the organization's management and its value and uniqueness can make a difference in achieving a durable competitive advantage.

Teece (2000: p. 12) expertly explained the relation between knowledge and competence. According to him, knowledge assets are based on people's experience and expertise and thanks to firms' physical, social and resource allocation structure knowledge can be transformed into competence. The set-up and use of knowledge and competencies shape competitive outcomes and the commercial success of the enterprise.

## **Tacit and codified knowledge**

The difference between tacit and codified knowledge, also called implicit and explicit knowledge, is based on one important factor: the codification of information. Specifically, codified, or explicit knowledge is the one that can be structured in precise forms and rules and thanks to this feature it can be easily transferred to the masses in a short period. The knowledge's transfer between people is indirect because it is done through impersonal tools, such as books and computers, but it has the benefit of being unbiased, clear, and homogeneous. Furthermore, another advantage of explicit knowledge is that *"the more a given item of knowledge or experience has been codified, the more economically it can be transferred"*. (Teece, 2000: p.13)

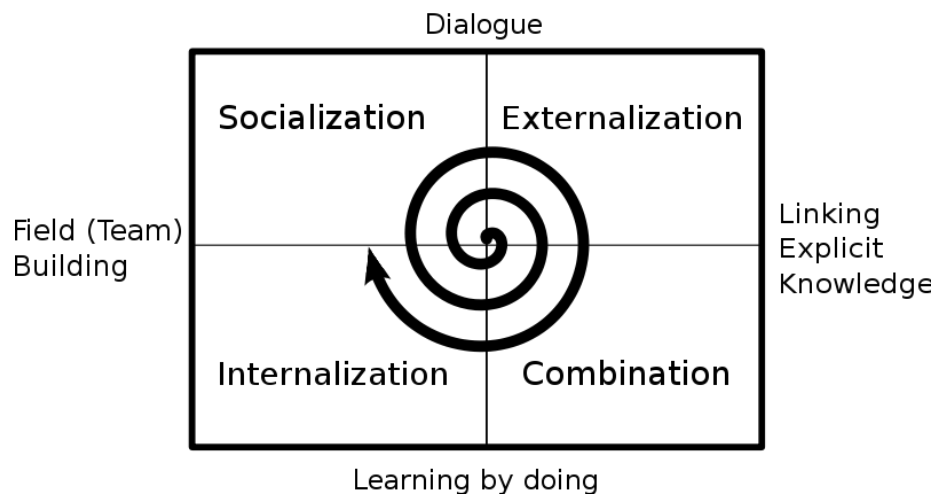
On the opposite side, we have implicit or tacit knowledge which *"is highly personal...hard to formalize and, therefore, difficult to communicate to others"*. (Nonaka, 1991: p. 165) This type of knowledge cannot be codified in rules because it is mainly personal and related to the context in which it is developed. As Polanyi (1983: p. 8) affirmed, in these cases, people know more than what they can tell.

The transfer of information in these conditions is slower and costly because the knowledge has to be transmitted face-to-face: usually, the person with expertise and advanced skills in the field shows and teaches to others. Learners need to see, replicate and train on the subject to acquire the same understanding and abilities and consequently, this process takes a longer time.

## **The spiral of knowledge**

The importance of knowledge within an organization has been discussed by Nonaka (1991: pp. 164-166) who coined the term *"The Spiral of Knowledge"* meaning that knowledge moves from being tacit to explicit, to return tacit again. Some years later, in 1995, Nonaka with the help of his colleague Takeuchi provided the model for knowledge creation and management illustrated in Figure 12.





**Figure 12:** The Spiral of Knowledge according to Nonaka. (Nonaka and Takeuchi, 1995)

According to the authors, knowledge is created by the interaction between four modes of knowledge creation or pillars of the operational knowledge dynamics:

- Socialization concerns the conversion of tacit into tacit knowledge and it involves the *“hidden and sticky part of all knowledge created at the individual level”*.
- Externalization transforms knowledge from tacit to explicit and it is a very important step because it permits to create new explicit knowledge, easier to communicate and transfer.
- Combination brings knowledge from explicit to explicit and it is *“a social process based on the communicable property of explicit knowledge”*.
- Internalization transforms knowledge from explicit to tacit leading to the embodiment of information and for this reason, how it is very close to earning-by-doing. (Bratianu and Orzea, 2010: p. 48)

These four modes of creating knowledge are very connected to three primary knowledge management activities proposed by Bontis and Fitz-enz (2002):

- knowledge generation through employee improvisation and innovation.
- knowledge integration into organizational systems, leading to transform tacit into explicit knowledge.
- knowledge sharing between people through the creation of appropriate socialization processes. (Bontis and Fitz-enz, 2002: p. 227)

Knowledge generation usually comes from an individual who is innovative or creative (it

can be the researcher working at the R&D department or the salesperson in the lower level of the chain). The new information that this individual has discovered is implicit in himself and it needs to be shared with other members of the organization to generate further information and beneficial outcomes. Knowledge integration between workers is the second of the three knowledge management activities and it is possible if tacit knowledge can be transformed into explicit. This is necessary because the more codified the information is the easier, faster, and less expensive is the sharing. If expert employees can codify and share their understanding, they will increase the amount of general knowledge within the firm, boosting human capital's value. The third activity consists of sharing such knowledge within the organization, helping the birth of new ideas and food for thought. Consequently, knowledge generates additional knowledge in a sort of virtuous circle. This property is typical of the previously mentioned knowledge-creating companies and one of the greater sources of competitive advantage.

## **SKILL**

### **General meaning**

Skill, together with competence, knowledge, and personal traits, is one of the main elements of human capital. It is necessary to keep in mind that there is not a unanimous and specific interpretation of the concept because many areas of human activity concern and involve skills. If we think about this, skills are involved in education and the correlated school subjects, but also music and physical activities, and a person can be skillful in logical thought or manual work. As Attewell (1990: p. 422) stated, *"sociology is not the only discipline whose substantive concerns demand an understanding of the skill. The concept is important in economics, psychology, education, computer science's "artificial intelligence", and in the area known as human factors or ergonomics"*.

Many authors and many schools of thought have tried to establish, and are still doing, a more clear and specific definition of the concept of skill. It is very complex and multifaceted and it has been defined in as many different ways as are the fields of study and research communities.

The general meaning of the term which everyone can find in the dictionary defines skill as *"the ability that comes from knowledge, practice, aptitude, etc., to do something well"*. (Esposito, 2008: p. 101) Consequently, if someone has a skill or is skilled in a field, it means

that he or she can perform such acts in a good way. Furthermore, the concept of ability can be defined as a synonym of skill and for this reason, they can be used interchangeably. Mumford and Peterson (1999: p. 76) define skill as *“a set of general procedures that underlie the effective acquisition and application of knowledge in different areas of endeavor”*. This statement highlights three different and interesting skill's features: first, there is a close link between skill and knowledge, meaning that both education and practice are relevant parts of the process and they are very interrelated. Second, there is the association of skill as a necessary method to perform multiple tasks. Third, skills are dynamic items that are not fixed but can be acquired, potentiated, and lost within the entire life of a person.

Once having discussed the concept of skill from the human resource perspective, we introduce the new and innovative skill-based approach to human resource management that is emerging in these decades.

### **Skill-based human resource management**

The role of human resources within the company is gaining a lot of space leading to the research of updated and innovative managerial approaches. Moving from human resource management based on job descriptions, to the more strategic one, until competency management, in the last century it has emerged and developed the new Skill-based Approach. (Lawler and Ledford, 1992) Emerging from the research of new sources of competitive advantage, this new approach focuses on the person and concerns the development of what type of skills each individual in the organization needs. A set of skills consistent with the core competencies of the organization and the type of management style is established. Following a skill-based approach, the attention is not anymore on the job description but on the range of skills the worker owns and the company searches for. (Lawler and Ledford, 1992: p. 6)

The skill-based approach brings out some questions like which are the skills necessary to compose the skill set required by the company? How do people know and can acquire the right amount and types of skill the firms will ask them? What is the role of education and the workplace in ensuring the acquisition and development of people's skills? We tried to find an answer to these questions in the last chapter which is dedicated to addressing the subject from the perspective of labour economics.

## CONSIDERATIONS ON TOPIC 2

This chapter exposes in detail the SLR about KSC's meaning according to Topic 2 (HRM perspective). Following the structure mentioned in the last part of the previous chapter and the one that will be recalled in the next ones, Figure 13 summarizes and categorizes the results of the literature review about the definitions of the three learning outcomes.

| TOPIC 2           | MEANING   |
|-------------------|---|
| <b>KNOWLEDGE</b>  | Knowledge is a driver of uniqueness and innovation and the fundamental element of human capital. Depending on its level of codification, it can be tacit or explicit, even if both types foster the generation and diffusion of new knowledge.  |
| <b>SKILL</b>      | Skill is justified by knowledge and practice of the procedure at hand. It's a dynamic human quality that can be learnt, developed and lost in all the possible domains.   |
| <b>COMPETENCE</b> | Competence is a holistic term that includes knowledge and skills relevant to the workplace, but also personal attitudes and behaviours. Depending on the context, it can be hard or soft, conceptual or practical and its final purpose within the company is generating sustained competitive advantage. |

**Figure 13:** Topic 2: KSC's meaning. (Personal elaboration)

From the collection of information and study of the many interpretations about KSC we derive three general explanations of the concepts. Specifically, knowledge is described as a driver of uniqueness and innovation and the fundamental element of human capital. Depending on its level of codification, it can be tacit or explicit, even if both types foster the generation and diffusion of new knowledge.

In the field of Topic 2, skill is a learning outcome justified by knowledge and practice of the procedure at hand. It's a dynamic human quality that can be learnt, developed, and lost in all the possible domains.

Finally, competence is defined as a holistic term that includes knowledge and skills relevant to the workplace, but also personal attitudes and behaviors. Depending on the context, it can be hard or soft, conceptual, or practical and its final purpose within the company is generating sustained competitive advantage.

Once more, KSC are very interrelated between them and each one is a necessary element

for the definition and development of the other. In particular, knowledge enhances itself in a virtuous cycle and is the foundation for the acquisition and potentiation of skill. Moreover, both knowledge and skill are crucial elements of competence as objective factors, together with some subjective ones like personal attitudes and behaviors.

## **CHAPTER 3: PERSPECTIVE OF INSTITUTIONAL ORGANIZATIONS**

### **INTRODUCTION**

This chapter deepens the perspective of policymakers and institutional organizations (Topic 3) on KSC. The actors involved in this field are many: from KSC's teaching to their learning and acquisition, differing in terms of actions and necessities. Industries and employers ask, and consequently establish, specific types and levels of KSC's requirements. Workers have to know which elements they should possess to apply for a job position and which kind of learning they should attend to achieve them. Education and training institutions have to create and develop the best tools and programs to deliver these powerful means. Policymakers have the role of controlling and regulating the relationships between the actors throughout evidence-based decisions. (European Commission, 2021)

Topic 3 is interesting due to the role institutions play in setting rules and actions to facilitate the comprehension of KSC's meaning and to manage their different treatment between occupations.

In Chapter 3 two matrices are illustrated to schematize, summarize, and unify the abundance of information available on the topic. The final aim is to present a clearer image of the actual situation concerning principally the definition of KSC and their relationship with policymakers.

### **INSTITUTIONAL ORGANIZATIONS**

KSC are widely reviewed by several organizations. We list some of those that will be cited later: the EU (European Union) and related OECD (Organization for Economic Co-operation and Development) and CEDEFOP (European center for the development of Vocational Training); the ILO (International Labour Organization) and many others. Particular attention will be dedicated to the studies and documents of the following organizations:

- The ESCO or the *“multilingual classification of European Skills, Competences, Qualifications and Occupations...supported by stakeholders and by the European*

*Centre for the Development of Vocational Training CEDEFOP*” (ESCO, 2020). (The current ESCO version, and the one we referred to, is the v1.0.8, last updated 27/08/2020).

The ESCO classification’s source is the European Qualifications Framework for Lifelong Learning (EQF). (EU, 2017: p. 17, point (23)) It is a “*common reference framework of eight levels of qualifications, expressed as learning outcomes with increasing levels of proficiency...The purpose...is to improve the transparency, comparability, and portability of people's qualifications*”. (EU, 2017: p. 15 point (3))

- The O\*NET OnLine, or Occupational Information Network, is “*sponsored by the U.S. Department of Labor, Employment & Training Administration, and developed by the National Center for O\*NET Development*”. (O\*NET, 2021)
- The ISFOL (Institute for the Development of Vocational Training of workers) implemented a website ([www.professioniooccupazione.isfol.it](http://www.professioniooccupazione.isfol.it)), “*at the request and on behalf of the Ministry of Labour...[whose] aim is to create a national observatory on occupations and their skill needs*” (ISFOL, 2021). (This classification uses ISTAT data from “L’indagine sulle professioni - Anno 2007”, Gallo, Scalisi and Scarnera, 2009)
- The WEF (World Economic Forum) “*is the International Organization for Public-Private Cooperation...It is independent, impartial and not tied to any special interests... [It operates stressing the idea that] an organization is accountable to all parts of society*”. (WEF, 2021 a) Impartiality, global attitude and social involvement are the principal motives of the choice of the World Economic Forum’s interpretation. Furthermore, WEF’s references usually are the above-mentioned O\*NET leading to higher consistency between the information.
- The UNIDO, or United Nations Industrial Development Organization, “*is the specialized agency of the United Nations that promotes industrial development for poverty reduction, inclusive globalization and environmental sustainability*”. (UNIDO, 2021)

## **COMPONENTS OF A JOB**

Topic 3 justifies the choice of investigating the meaning and value of KSC because they are the main components of an occupation. From a WEF elaboration, the elements of a job can

be categorized into three main groups (Figure 14):

- Work activities or the range of tasks that needs to be accomplished within a job role.
- Aptitudes which are made by knowledge, skills, and abilities (KSA model).
- Experience that is defined in terms of time spent in education, years of work experience and years of job family experience. (WEF, 2018 b: p. 5)

| Content   | Aptitudes  | Experience  |
|---|--|---|
| <p><b>Work activities</b> are the range of tasks that need to be accomplished within a job role</p> | <p><b>Knowledge</b> is the body of facts, principles, theories and practices that acts as a foundation for skills</p> <p><b>Skills</b> are used to apply knowledge to complete tasks</p> <p><b>Cross-functional skills</b> are skills required by a variety of job roles which are transferrable to a broad range of job role</p> <p><b>Specialized skills</b> are particular to an industry or a job role and are not easily transferable (e.g. skills related to the use, design, maintenance and repair of technology)</p> <p><b>Abilities</b> are the range of physical and cognitive capabilities that are required to perform a job role</p> | <p><b>Time spent in education</b> is the duration of time spent gaining knowledge and skills through a formal route of training</p> <p><b>Years of work experience</b> are the time spent forming and improving skills to apply a given knowledge through on-the-job practice</p> <p><b>Years of job family experience</b> are the share of work experience to date that has been spent within related professions which exhibit similarities in their required skills, knowledge and overall profile</p> |

Note: Elaboration based on taxonomies by Burning Glass Technologies and Occupational Information Network (O\*NET).

**Figure 14:** Components of a job. (WEF, 2018 b: p. 5)

Figure 14 illustrates which are the job activities that the worker has to perform, the aptitudes necessary to accomplish them and the consequent education and work experience the person acquires.

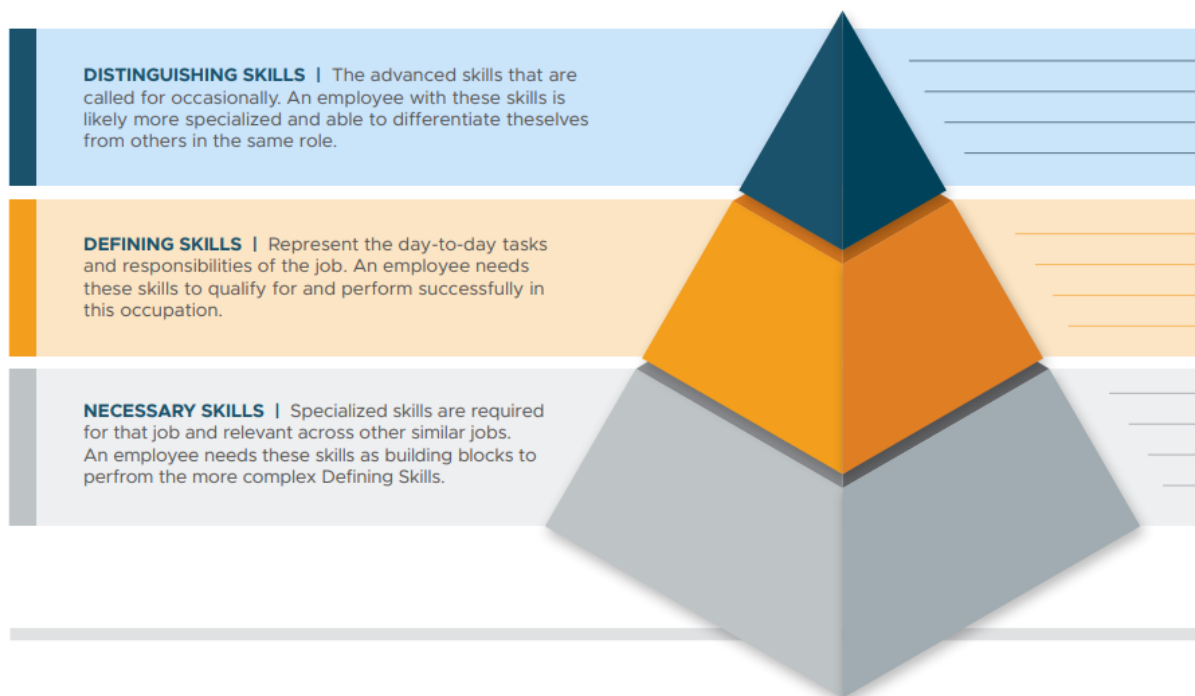
Defining these components is useful both from an individual and collective point of view. Taking an individual perspective, each worker will better understand the skill sets asked by employers and the associated salaries and job titles. (Djumaieva and Sleeman, 2018: p. 14) Thanks to this classification people have open access to the information necessary for job application: they can evaluate if they own the right KSC or if they have to attend educational and training courses to acquire them. From a collective point of view, having common taxonomies across different languages, sectors and economies can favor better outcomes at the global level. People can move vertically between different levels of occupations or horizontally changing sectors or countries. Furthermore, in the actual global and digital economy, people move and communicate very fast: they can work all



around the world or in smart working at home for a company thousands of kilometers away. For these reasons, job's element classification has the aim of helping both companies and policymakers in grasping the necessities of an increasingly globalized society.

Another very useful tool to characterize the specificities of a job is the Occupational Skill Framework from Burning Glass Technologies (BGT, 2019). This classification focuses on skills to describe job roles according to three categories. In order of importance, from the top to the base of the pyramid (Figure 15), we have:

- Distinguishing skills are sets of skills that allow job seekers to highlight their technical proficiency in the role and to differentiate themselves from other candidates.
- Defining skills are needed to qualify for a job and perform day-to-day tasks and responsibilities successfully.
- Necessary skills are required for a specific job and are also relevant across other similar jobs. An employee needs these skills as building blocks to perform the more complex Defining Skills. (BGT, 2019: p. 10-11)



**Figure 15:** Skill Burning Glass Taxonomy. (BGT, 2019: p. 11)

For the purposes of our discussion, we will consider the WEF components of a job (Figure 14) as the guiding principle in defining work activities. Therefore, in the next paragraphs, we deepen the investigation of aptitudes which include the three most important elements of human capital: KSA.

## **APTITUDES**

Aptitudes category includes the most relevant terms of the KSA model. They have been studied and defined by many scholars: Snow (1980: p. 27) writes that “*aptitudes are psychological constructs about individual differences in learning or performance in specified situations*”; Vinkhuyzen et al. (2009: p. 380) affirm that they concern “*domain-specific skill within the normal ability range of the general population*”. Specificity characterizes aptitudes and this attribute is proper of the elements contained in this group too. KSA distinguish one occupation from another, characterizing the specificity of each work activity.

## **Organization/Learning outcome matrix**

Once we have collected and elaborated the numerous sources of information regarding the subject, we realize that each organization has elaborated its explanation. For ease, we present our findings using a table. The following Organization/Learning outcome matrix (Figure 16) collects all meanings from the most important organizations or institutions. On the horizontal axis we have organizations’ names and on the vertical one the most important learning outcomes.

|           |            | ORGANIZATIONS   |  |   |   |   |
|-----------|------------|---|--|---|---|---|
| CONCEPTS  |            | WEF   | ESCO   | O*NET   | ISFOL   | UNIDO   |
| APTITUDES | KNOWLEDGE  | Knowledge is the body of facts, principles, theories and practices that acts as a foundation for skills.                          | The body of facts, principles, theories and practices that is related to a field of work or study. Knowledge is described as theoretical and/or factual, and is the outcome of the assimilation of information through learning. | Organized sets of principles and facts applying in general domains.                       | Knowledge is a structured set of information, principles, practices and theories necessary for the proper conduct of the job.                   |   |
|           | SKILL      | Skills are used to apply knowledge to complete tasks.   |  | Developed capacities that facilitate learning or the more rapid acquisition of knowledge. | Skills are sets of general cognitive procedures and processes that determine the ability to perform properly the tasks associated with the job. |   |
|           | ABILITIES  | Abilities are the range of physical and cognitive capabilities that are required to perform a job role.                           |  | Enduring attributes of the individual that influence performance.                         |   |   |
|           | COMPETENCE | Collection of skill, knowledge, attitudes and abilities that enable an individual to perform job roles                            | The proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations, and in professional and personal development.   |   |   | A set of skills, related attributes that allow an individual to perform a task or activity within a specific function or job. |
|           | ATTITUDES  | Learned behaviours, emotional intelligence traits and beliefs influence individuals' approaches to ideas, persons and situations. |  |   |   |   |

**Figure 16:** Organization/concept matrix. (European Commission, 2017; Gallo, Scalisi and Scarnera, 2009; O\*NET, 2021; UNIDO, 2002; WEF, 2018 b)

## **KNOWLEDGE**

The first element of the aptitudes' group that we discuss is knowledge. The governmental and non-governmental institutions that provide a clarification of the subject are WEF, ISFOL, ESCO and O\*NET.

WEF (2018 b: p. 5) states that *"knowledge is the body of facts, principles, theories and practices that acts as a foundation for skills"*; ISFOL (Gallo, Scalisi and Scarnera, 2009: p. 35) provides its definition as follow: *"knowledge is a structured set of information, principles, practices and theories necessary for the proper conduct of the job. They are acquired through formal processes (education, training, and vocational training) and/or through experience"*.

The ESCO affirms that knowledge is *"the body of facts, principles, theories and practices that is related to a field of work or study. Knowledge is described as theoretical and/or factual and is the outcome of the assimilation of information through learning"*. (European Commission, 2017: p. 18) O\*NET (2021) asserts that knowledge is constituted by *"organized sets of principles and facts applying in general domains"*.

The similarities between these references regard two main aspects: the first is the fact that all knowledge's interpretations include terms like principles, facts, theories, and practices, recalling to the knowledge of something already defined and established. The second shared aspect regards the domain in which such knowledge can be applied: from job to study, until any general domain.

Another interesting point is the process through which knowledge can be acquired. In particular, the ISFOL mentions formal processes and experience and the ESCO highlights the power of learning for the attainment of knowledge.

## **SKILLS**

Skills merit a detailed discussion in our analysis because many scholars, institutions and policymakers dedicated several studies on this complex and multifaceted topic. The organizations that provide their interpretation are WEF, ESCO, O\*NET and ISFOL.

WEF (2018 b: p. 5) states that *"skills are used to apply knowledge to complete tasks"*, while ESCO defines skills as *"the ability to apply knowledge and use know-how to complete tasks and solve problems"* (European Commission, 2017: p. 18). The American O\*NET reports that skills are *"developed capacities that facilitate learning or the more rapid acquisition of*

*knowledge*". (O\*NET, 2021)

The ISFOL, affirms that "*skills are sets of general cognitive procedures and processes that determine the ability to perform properly the tasks associated with the job. These processes are learned over time and they enable the acquired knowledge to be effectively transferred through the work*". (Gallo, Scalisi and Scarnera, 2009: p. 36)

In general, skills are defined as the application of possessed knowledge or as "*developed capacities*" (O\*NET, 2021), highlighting knowledge as an antecedent of skills. People have to acquire and control their level of cognitive understanding before being able to perform and apply a certain level of skills.

Between the different organizations' interpretations, an evident similarity concerns the aim of skills: the ability to complete general tasks, or more specific work activities. The O\*NET statement focuses more on knowledge and defines the goal of skills as the acquisition of a higher level of the latter. This interpretation is not far from the previous ones because it is from the performance of tasks that people can improve their understanding of the job, or on the subject they are involved in.

### *Skill taxonomies*

Many scholars and institutions studied skills and their origins trying to provide a classification. There are many skill types according to the field in which they are applied, the cognitive or practical features and the general or more specific characteristics.

The clearest and useful tools that categorize skills are taxonomies or "*standardized, structured database language*" (BGT, 2021) that individuals and companies, but also governments, can consult. These classifications not only provide a common terminology across sectors and countries, but such taxonomies provide a foundation for measuring the similarity of occupations based on KSC. These insights could be directly applied to inform policy on reskilling and identifying job transition opportunities for occupations at risk of decline. (Djumalievá and Sleeman, 2018: p. 14)

### *Skill taxonomies matrix*

Here there are the principal and most famous skill taxonomies. The following table (Figure 17) contains skill types that come from the intersection of two axes: on the top of the matrix, we have the main organizations that provide a personal classification and

inside the boxes the many skill types they have identified.

|             | WEF                            | ESCO                         |                  | O*NET                          | NESTA  | BGT              |
|-------------|--------------------------------|------------------------------|------------------|--------------------------------|--|------------------|
| SKILL TYPES | BUSINESS SKILLS                | COGNITIVE SKILLS             | PRACTICAL SKILLS | BASIC SKILLS                   | BUSINESS ADMINISTRATION SKILLS               | BASILENE SKILLS  |
|             | INNOVATION & CREATIVITY SKILLS | TRANSVERSAL SKILLS           |                  | COMPLEX PROBLEM SOLVING SKILLS | EDUCATION, SALES & MARKETING SKILLS          | TECHNICAL SKILLS |
|             | DIGITAL SKILLS                 | CROSS - SECTORAL SKILLS      |                  | RESOURCE MANAGEMENT SKILLS     | ENGINEERING, CONSTRUCTION & TRANSPORT SKILLS |                  |
|             | INDUSTRY - SPECIALIZED SKILLS  | SECTOR - SPECIFIC SKILLS     |                  | SOCIAL SKILLS                  | INFORMATION TECHNOLOGY SKILLS                | SOFTWARE SKILLS  |
|             | CROSS - FUNCTIONAL SKILLS      | OCCUPATION - SPECIFIC SKILLS |                  | SYSTEM SKILLS                  | HEALTH & SOCIAL CARE SKILLS                  |                  |
|             | SPECIALIZED SKILLS             |                              |                  | TECHNICAL SKILLS               | SCIENCE & RESEARCH SKILLS                    |                  |

**Figure 17:** Skill taxonomies matrix. (BGT, 2019; Djumalieva and Sleeman, 2018; European Commission, 2017; O\*NET, 2021; WEF, 2018 b, 2020)

The WEF column shows six types of skills: business skills, innovation & creativity skills, digital skills, industry-specialized skills (Which are additionally subdivided into more specific skill types. For the complete classification see page 155, WEF, 2020), together with Cross-functional and Specialized skills. The first groups are successful in many domains and transferable across jobs, while the second are not transferable and, as the

name suggests, they are specific to a single role.

The ESCO affirms that “*skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments)*”. (European Commission, 2017: p. 18) Within these two general categories, the ESCO lists four specific types of skills:

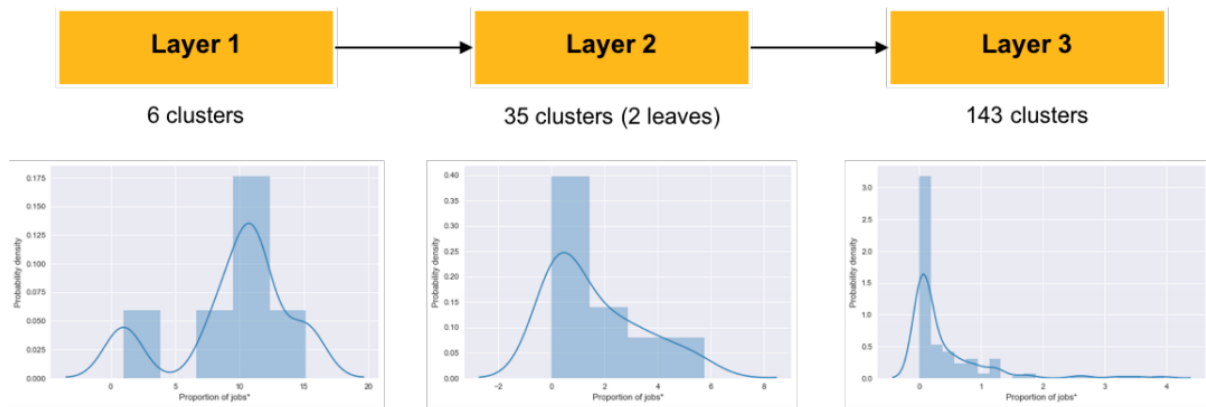
- Transversal skills are relevant to a broad range of occupations and sectors...[they] are the building blocks for the development of the "hard" skills and competencies required to succeed in the labour market.
- Cross-sectoral skills are relevant to occupations across several economic sectors.
- Sector-specific skills are specific to one sector but are relevant for more than one occupation within that sector.
- Occupation-specific skills are usually applied only within one occupation or specialism. (European Commission, 2017: p. 19)

The O\*NET column in the matrix provides a list of six macro-categories of skills:

- Basic Skills: Developed capacities that facilitate learning or the more rapid acquisition of knowledge.
- Complex Problem-Solving Skills: Developed capacities used to solve novel, ill-defined problems in complex, real-world settings.
- Resource Management Skills: Developed capacities used to allocate resources efficiently.
- Social Skills: Developed capacities used to work with people to achieve goals.
- Systems Skills: Developed capacities used to understand, monitor, and improve socio-technical systems.
- Technical Skills: Developed capacities used to design, set up, operate, and correct malfunctions involving the application of machines or technological systems. (O\*NET, 2021)

Within each of these categories, there are additional and more detailed types of skills. (For further information see O\*NET, 2021)

The UK skill taxonomy (Djumaliev and Sleeman, 2018: p.10) identifies six macro-categories or clusters of skills that belong to Layer 1 of the taxonomy, which in turn detects three layers and further detailed clusters and skill's types (Figure 18).



**Figure 18:** Number of clusters in each layer of the skill taxonomy. (Djumaieva and Sleeman, 2018: p.10)

In the last column of the taxonomies matrix, we have the Burning Glass Technologies (BGT) skill taxonomy. Within its classification “*the skills are organized into skill clusters, which are groupings of similar skills and into skill types – specialized, software, and baseline*” (BGT, 2019: p. 3). Burning Glass’s skill taxonomy includes three skill types:

- Baseline Skills such as communication, problem-solving, and creativity.
- Technical Skills such as welding, software development, and financial analysis.
- Software Skills such as Adobe Photoshop, SQL, and AutoCAD. (BGT, 2019: p. 4)

### *Similarities of taxonomies*

Looking at the skill taxonomies matrix (Figure 17) we can individuate some similarities between the different skill taxonomies. In particular, both the O\*NET and the BGT identify in their taxonomy the category of “*baseline or basic skills*”: as the name suggests they are the skills at the basis for the development of further and more complex skills, hence it is easier to acquire them.

The other two common points regard the specificity of skills: both WEF and ESCO establish “*cross-functional/cross-sectoral/transversal skills*” and, on the opposite, “*industry-specialized/specialized/sector-specific/occupation-specific skills*”. On the one hand, the first categories describe skills that can be used in many domains without problems of usefulness; on the other hand, the second categories include skills that can be used to complete tasks in a specific domain, sector, or occupation.

By concentrating our attention on the O\*NET and the BGT taxonomies, we can see the



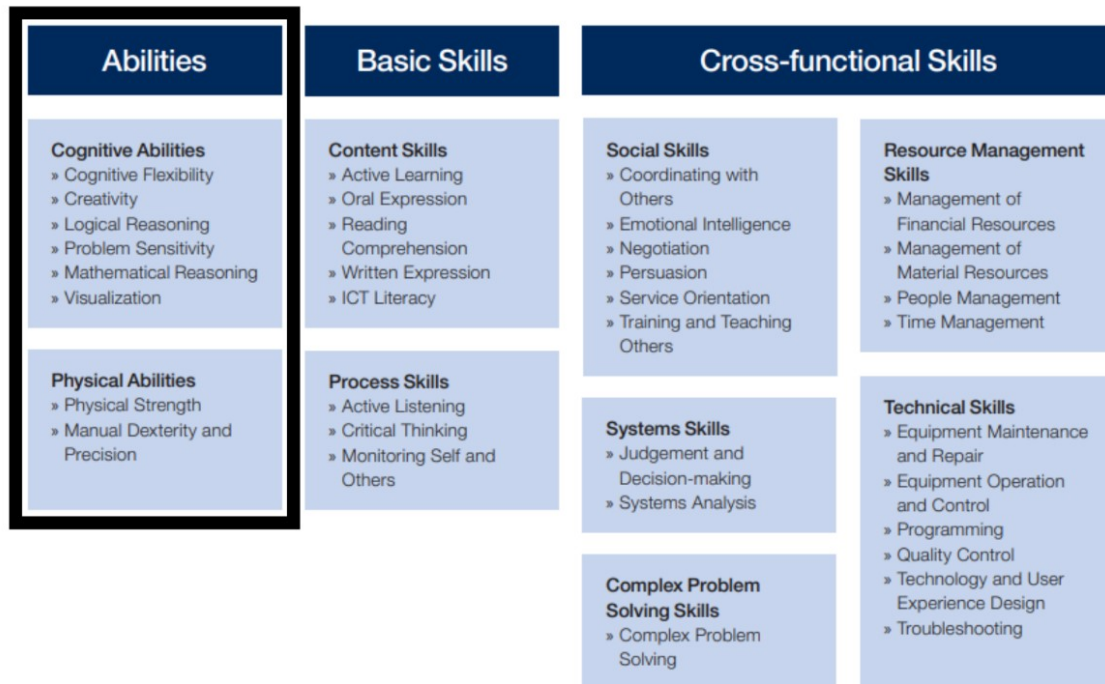
same “technical skills”, useful for machine maintenance. While in the WEF and the UK skill taxonomy columns we have the same “business/business-administration skills”. UK skill taxonomy, WEF and BGT identify “digital/information-technology/software skills” or the skills about software and technology systems operations.

We should not be surprised about the identification of many similar categories and types of skills; indeed, this characteristic demonstrates consistency across different countries and organizations.

This result confirms the final aim of all taxonomies and classifications: establishing a common and universal terminology to contribute to modernizing education and training systems and to increase the employability, mobility and social integration of workers and learners. (EU, 2017: p. 15 point 4)

## **ABILITIES**

Both WEF and the O\*NET provide their interpretation of ability. According to the WEF (2018 b: p. 5) “*abilities are the range of physical and cognitive capabilities that are required to perform a job role*”. This organization recognizes two types of abilities: cognitive and physical abilities (Figure 19).



Source: World Economic Forum, based on O\*NET Content Model.  
 Note: See Appendix A for further details.

**Figure 19:** Core work-related skills. (WEF, 2016: p. 21)

As the source of Figure 19 suggests, this WEF schema is based on the O\*NET (2021) data and classification which defines abilities as “*enduring attributes of the individual that influence performance*”. The American O\*NET classifies:

- Cognitive Abilities that influence the acquisition and application of knowledge in problem-solving.
- Physical Abilities that influence strength, endurance, flexibility, balance, and coordination.
- Psychomotor Abilities that influence the capacity to manipulate and control objects.
- Sensory Abilities that influence visual, auditory and speech perception. (O\*NET, 2021)

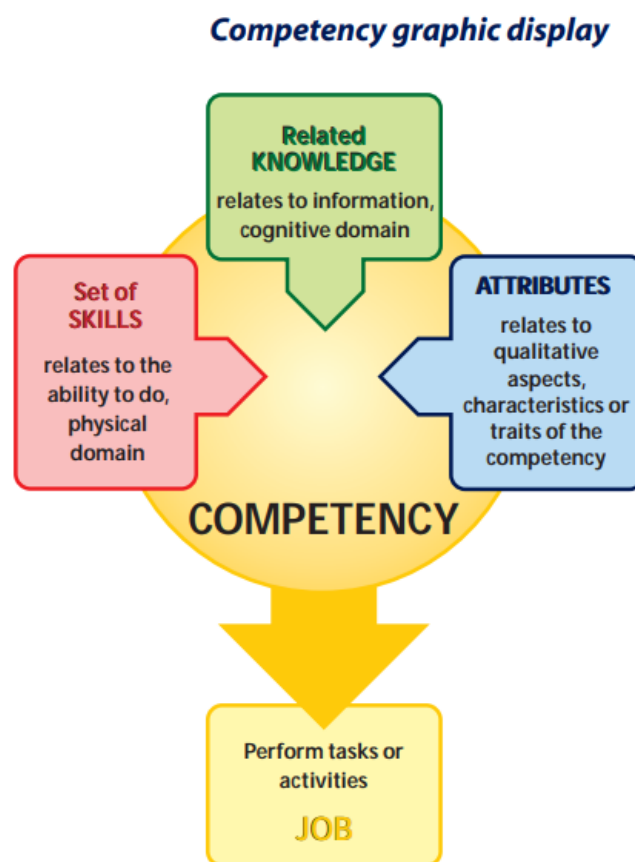
Once more, commonalities between taxonomies highlight the purpose of institutions, policymakers, and countries to have a shared and comprehensive terminology.

## COMPETENCE

Competence is the third element of the KSC group. The ESCO states that competence is “the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations, and professional and personal development”. (European Commission, 2017: p. 18)

The UNIDO (2002) defines competence as “a set of skills, related knowledge and attributes that allow an individual to perform a task or an activity within a specific function or job”.

This affirmation is representative of Figure 20:



**Figure 20:** Competency graphic display (UNIDO, 2002: p. 9)

Furthermore, the UNIDO (2002: p. 9) provides a classification of competencies into three categories:

- Managerial competencies that are considered essential for staff with managerial or supervisory responsibility in any service or program area, including directors and senior posts. Some managerial competencies could be more relevant for

specific occupations; however, they are applied horizontally across the Organization, i.e., analysis and decision-making, team leadership, change management, etc. (For further information about managerial competencies and the elements within this category see pp.12-19, UNIDO, 2002)

- Generic competencies that are considered essential for all staff, regardless of their function or level, i.e., communication, program execution, processing tools, linguistics, etc.
- Technical/Functional Competencies which are considered essential to perform any job in the Organization within a defined technical or functional area of work, i.e., environmental management, industrial process sectors, investment management, finance and administration, human resource management, etc.

The application of such types of competencies can happen in three levels: Advanced, Proficient and Knowledgeable. Respectively, from the level with higher understanding and expertise on the competence (it can be performed without external guidance) to the level with lower understanding and expertise (it cannot be performed without external guidance). (UNIDO, 2002: p. 11)

The WEF interpretation (2021 b: p. 7), similar to UNIDO's one, asserts that competence is the "*collection of skill, knowledge, attitudes and abilities that enable an individual to perform job roles*". A clear representation of the structure of the concept is provided in the following Figure 21:

**Competencies** — Collection of skills, knowledge, attitudes and abilities that enable an individual to perform job roles

**Skills and Knowledge**

Skills are the capabilities needed to complete a task, and therefore a job.

Knowledge is the body of facts, principles and theories that are related to a field of work or study, and that can be further split into dependent knowledge (practical and procedural) and context-independent or theoretical knowledge.

**Attitudes**

Learned behaviours, emotional intelligence traits and beliefs that individuals exhibit that influence their approach to ideas, persons and situations.

**Abilities**

Possession of the physical, psychomotor, cognitive and sensory means to perform a job.

**Figure 21:** Definitions. (WEF, 2021 b: p. 7)

All the interpretations of the concept have in common the elements constituting competence and the purpose of its use. ESCO, UNIDO and WEF consider an individual's competence as a sort of box containing all its knowledge, skills, attitudes, and abilities.

The concept of competence has been studied a lot because of the difficulty of identifying a specific description. The actual classifications present a comprehensive explanation of the term, including all the aspects from skills to knowledge and from abilities to attitudes.

**Competence and skill**

The ESCO realized that sometimes the concepts of skill and competence are used as synonyms, leading to misunderstanding and confusion. Hence, it specifies the distinction between the two: *“Skill refers to the use of methods or instruments in a particular setting and relation to defined tasks [while] competence is broader and refers to the ability of a person, facing new situations and unforeseen challenges, to use and apply knowledge and skills in an independent and self-directed way”*. (European Commission, 2017: p. 19)

The OECD declares that “*A competence is not limited to cognitive elements (involving the use of theory, concepts or tacit knowledge); it also encompasses functional aspects (involving technical skills) as well as interpersonal attributes (e.g., social or organizational skills) and ethical values*”. (Ananiadou and Claro, 2009: p. 8)

Hence, the main difference between skills and competence is the comprehensive characterization of the latter.

## **ATTITUDES**

According to the WEF (2021 b) attitudes are one of the components of competence. Specifically, it defines them as “*learned behaviors, emotional intelligence traits and beliefs that individuals exhibit that influence their approach to ideas, persons and situations*”.

The WEF in the 2020’s classification (p. 156) calls them “interpersonal attitudes” and it individuates three subcategories: “*working with people, self-management, social justice*”. (For the complete attitudes’ classification see page 156, WEF, 2020)

The ISFOL provides an interpretation of attitudes affirming that “*attitudes are the cognitive, physical, sensory and perceptual characteristics of the individual which affect the conduct of the job and the performance of the tasks and related work activities*”. (Gallo, Scalisi and Scarnera, 2009. p. 36)

Recalling the most important characteristics of attitudes, we have that they represent the most personal and subjective side of an individual’s competence. They belong to the emotional and values sphere. Giving their inner source, attitudes can highly influence how individuals approach specific life conditions and tasks that have to be accomplished. Attitudes affect people's actions in terms of methods and tools used to complete them.

### CONSIDERATIONS ON TOPIC 3

This chapter presents a full description of the most discussed concepts from the many institutional organizations perspective. To clarify and summarize the myriad of information provided, we created the table in Figure 22.

|           | CONCEPTS   | DEFINITION  |
|-----------|------------|---|
| APTITUDES | KNOWLEDGE  | Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study. Knowledge is described as theoretical and/or factual and is the outcome of the assimilation of information through learning. (ESCO) |
|           | SKILL      | Skills are sets of general cognitive procedures and processes that determine the ability to perform properly the tasks associated with the job. (ISFOL)   |
|           | ABILITIES  | Abilities are the range of physical and cognitive capabilities that are required to perform a job role. (WEF)   |
|           | COMPETENCE | Competence is the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations, and in professional and personal development. (ESCO)   |
|           | ATTITUDES  | Attitudes are the cognitive, physical, sensory and perceptual characteristics of the individual which affect the conduct of the job and the performance of the tasks and related work activities. (ISFOL)   |

**Figure 22:** Topic 3: KSC’s meaning. (European Commission, 2017; Gallo, Scalisi and Scarnera, 2009; WEF, 2018 b)

We chose the ESCO’s knowledge definition (European Commission, 2017: p. 18) because it is the most comprehensive one: it includes all the theoretical terms (principles, theories, facts...) and it also provides the process through which knowledge can be acquired (learning).

Skill meaning (from the ISFOL; Gallo, Scalisi and Scarnera, 2009: p. 36) recalls the idea that knowledge achievement is the foundation for learning skills. Furthermore, it specifies the purpose of skills that is completing a task or a work activity.

The last aptitudes’ component is abilities and the WEF (2018: p. 5) interpretation has been chosen because it highlights the physical and cognitive perspectives of a job role.

Attitude's ISFOL definition is the clearest because it tells us that cognitive, physical, sensory, and perceptual traits of people can affect their decision making and performance of any activity. (Gallo, Scalisi and Scarnera, 2009. p. 36)

The last concept we need to consider is competence. The ESCO interpretation comprehends and specifies all the previous notions, which is the reason for its choice in the summary table. (European Commission, 2017: p. 18)

The definitions of KSC will be extracted from Figure 22 and they will be compared in the final chapter with the ones from the other topics. The emerging considerations are the main findings of this research.



## CHAPTER 4: THE PERSPECTIVE OF LABOUR ECONOMICS

### INTRODUCTION

Chapter 4 goes into the final considerations gathered from the perspective of labour economics and it is subdivided into three main sections according to the main purposes of the thesis.

The first section covers the final comparison between KSC definitions resulting from the other Topics and it provides the specific meaning of the concepts emerging from the SLR. The second purpose of the chapter is about the identification of the new role KSC are assuming in the labour markets of the digital age. The related section highlights the potential challenges digital progress and job evolution can cause, together with the available opportunities. Furthermore, this section stresses the necessity of human capital potentiation along with the introduction of new technologies and job requirements through upskilling, reskilling and lifelong learning.

The final part of Chapter 4 addresses the identification and monitoring of the future trends that can affect the evolution of jobs and, consequently, KSC. Studying 21st-century skills, STEM and STEAM approaches, we determined that the two principal trends shaping job and skill evolution are digitalization and human centrality, together with the rising role of artistic and creative disciplines enhancing higher-order skills acquisition.

#### **Labour economics and economics of innovation**

*“Labor economics studies how labour markets work”* (Borjas, 2013: p. 1) analyzing employment trends and the job requirements that make people active participants in the business environment. *“Economics of innovation is a distinctive area of specialization within economics, with a well-defined set of competencies about the origins, causes, characteristics and consequences of the introduction of technological and organizational changes in the economic system”*. (Antonelli, 2009: p. 640) These two fields of research are very interrelated, especially after the advent of the technological revolution of the 21st century: innovation is one of the first drivers of social and economic growth concerning all fields of the knowledge society, labour market included.

In the next section, we mix the two perspectives to identify which are the KSC fostering growth and innovation. Labour market dynamics find solutions in the equilibrium

between demand and supply of labour or in the match between employers' requirements and workers' supply. Both educational sciences (Topic 1) and human resource management (Topic 2) are of crucial importance in characterizing labour economics outcomes.

In the knowledge economy, policymakers, and affiliated associations (Topic 3) play an important role in drafting and issuing regulations that are respected in single countries and all over the world. The necessity of common and shared actions and laws are important to reduce conflicts between parts and to minimize the differences between different labour markets.

Labour economics is the science that involves all the other Topics and that is why we take it as a guideline in concluding the SLR.

## **DEFINITION OF THE CONCEPTS OF KSC**

The first objective of the thesis is to provide the specific meaning of KSC in the digital economy. The SLR performed and described in the previous chapters furnished interesting results in terms of richness, comprehensiveness, and clarity. The obtained information has been collected in the following table (Figure 23) which crosses two axes: on the horizontal one, there are the three Topics, whereas on the vertical one there are KSC concepts.

The scope of this table is, from one hand, collecting altogether the necessary considerations, and from the other, helping the reader to individuate and understand the similarities between the Topics.

|                   | Topic 1   | Topic 2   | Topic 3  |
|-------------------|---|---|--|
| <b>KNOWLEDGE</b>  | Knowledge is the sum of principles and facts people acquire during their learning process and that they can use and tailor according to the situation at hand. Knowledge is catalogued in typologies according to its characteristics of automation, generality and level.                                  | Knowledge is a driver of uniqueness and innovation and the fundamental element of human capital. Depending on its level of codification, it can be tacit or explicit, even if both types foster the generation and diffusion of new knowledge.  | The body of facts, principles, theories and practices that is related to a field of work or study. Knowledge is described as theoretical and/or factual and is the outcome of the assimilation of information through learning. (ESCO) |
| <b>SKILL</b>      | Skills are an organized sequence of activities with a specific purpose that depends on the situation. They are not stable characteristics but they can be learned, developed and lost over life. The typologies depend on the specificity, transferability and the process through which they are acquired. | Skill is justified by knowledge and practice of the procedure at hand. It's a dynamic human quality that can be learnt, developed and lost in all the possible domains.   | Skills are sets of general cognitive procedures and processes that determine the ability to perform properly the tasks associated with the job. (ISFOL)  |
| <b>COMPETENCE</b> | Competence is a specific characteristic of the person constituted by skill and knowledge but also personal traits, values and attitudes. It predicts people's behaviour in terms of performance and context of action, from the job profession to the general role or situation.                            | Competence is a holistic term that includes knowledge and skills relevant to the workplace, but also personal attitudes and behaviours. Depending on the context, it can be hard or soft, conceptual or practical and its final purpose within the company is generating sustained competitive advantage. | The proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations, and professional and personal development. (ESCO)   |

**Figure 23:** Comparison between KSC's meanings. (Personal elaboration)

### Considerations across perspectives

Each column of the table has been considered in one of the first three chapters performing the SLR from the same perspective. On the other hand, in this section, we study and

compare the definitions of the same concept according to the three different Topics (considering the rows of the table in Figure 23).

Starting from the first row, the proposed definitions of knowledge have some points in common. In particular, both Topic 1 and 3 define knowledge in terms of principles and facts. What brings together and unite all three Topics is the process through which knowledge is acquired and the specificity of knowledge according to the domain to which it is related. The relatedness to the context makes knowledge identifiable in many typologies depending on its automation, generality, and level of codification.

The second row concerns skill. Both Topic 2 and 3 associate skills with the knowledge that can be theoretical or practical (*"justified by knowledge and practice of the procedure"* and *"sets of general cognitive procedures and processes"*). The common ground between Topic 1 and Topic 2 regards the characteristics of dynamicity that describe the concept of skill: it is not considered a stable human quality because it can be learnt, developed, and lost over life. Skill and knowledge have in common the specificity of the domain to which they are related.

The last row of Figure 23 illustrates the definitions of competence. The idea that is similar in all the Topics is that both skill and knowledge are part of competence, together with personal traits, values, attitudes, behaviors, and abilities. Another common point concerns the profitable outcome of competence application: it *"predicts people's behavior in terms of performance"* (Topic 1), it *"generates sustained competitive advantage"* (Topic 2) and it enhances *"professional and personal development"* (Topic 3).

From these considerations we can deduce the shared points between the Topics that help us in providing the final comprehensive definitions of KSC which are listed in Figure 24:

|                   | <b>MEANING</b>   |
|-------------------|--|
| <b>KNOWLEDGE</b>  | Knowledge is made by theories and principles that are acquired throughout the learning process and that can be tailored by the human being according to his need.        |
| <b>SKILL</b>      | Skills are a sequence of theoretical and practical procedures goal-oriented. They are dynamic and each person can learn, develop and lose them.                          |
| <b>COMPETENCE</b> | Competence is underpinned by knowledge and skills together with the more personal traits of the person and its application generates profitable outcomes in all domains. |

**Figure 24:** KSC's meaning. (Personal elaboration)

These definitions are resulting from the SLR of the existing and wide literature available on the topic and they are useful to comprehend the following part of the discussion.

## **THE NEW ROLE OF KSC IN THE LABOUR MARKET**

The second objective on which the thesis focuses is about investigating the new role that KSC are assuming in labour markets. The focus of the present section is on the specific weight the learning outcomes have in affecting demand and supply of labour and on their function in shaping the role of the worker in the actual and future workplace.

In the last few years, many authors have investigated the relationship between human operators and machines in Industry 4.0. They concentrate their attention on the new tools available in supporting work operations (from the more practical to the more data-processing ones), on which KSC employees have to possess to cooperate with the surrounding infrastructures and on which are the best conditions for the human being in an efficient working system. (e.g., Longo et al., 2017; Romero et al., 2017)

If we consider the circumstances that characterize the knowledge economy, labour trends are even more complex and challenging to comprehend and forecast. The working conditions emerging from the cooperation between human resources and machines,

robots or software led to the consolidation of the so-called smart factories. The latter are *“featured by a seamless integration of advanced manufacturing capabilities with digital infrastructures able to capture, generate and spread intelligence through improved monitoring, analytics, modelling and simulation”*. (Romero et al., 2017: p. 144) These digital and knowledge-based systems have two pillars: automation and intelligence, which are embedded in technologies and workers. Hence, employees of smart factories need to develop an advanced human-machine interaction.

Human resources within smart factories are not less important than the new infrastructures that Industry 4.0 is providing. The differential contribution that a worker can give is one of the primary resources that a company has in aspiring at a sustained competitive advantage. Together with scholars, institutional organizations such as the European Factories of the Future Research Association (EFFRA), support the idea that *“human-centricity will be needed in factories of the future in order to increase flexibility, agility, and competitiveness”*. (EFFRA, 2013: p. 86)

Workers' cooperation and integration with hard and soft company's resources affects the development of employees' KSC in synergy with technological progress. This mutual adaptation justified and guided the ever-changing job requirements in the labour market. Both future workers and enterprises have to be prepared for the digital challenges: they should both transfer KSC to the next generations and improve them when they become obsolete. In particular, *“factory workers (future knowledge-workers) will be given increased opportunities for continuous development of their skills and competencies through novel knowledge and capturing delivery mechanisms”*. (EFFRA, 2013: p. 86)

### **Digital progress: challenges and threats**

Considering the perspective of employees, their main challenge is the rapid and continuous change of the workplace in terms of economic, organizational, and technological transformation. (EFFRA, 2016: p. 30) Together with job tasks and technologies workers' KSC have to evolve and adapt to the emerging working conditions. These conditions offer both challenges and opportunities that HRM and companies have to address to stay competitive and innovative.

In the next paragraphs, we examine the difficulties that can arise from the digital transformation and the automation of the workplace, together with the availability of solutions in terms of upskilling, reskilling and lifelong learning.

### *Skill gap and mismatch*

Considering first the challenges and threats that can emerge from the digital revolution, we want to discuss the potential skill-related problems in terms of inappropriate quality and quantity.

Generally, there is confusion in the identification of the meaning of terms like skill gap and mismatch. The difficulties are due to the similarities between the concepts and their possibility of overlapping. BCG defines skill gap as “*the unavailability of enough candidates with the skill sets needed to fill vacancies*”, while skills mismatch is the situation in which people’s qualifications are not needed for the jobs they actually do. (Hoteit et al., 2020: p. 1) The two principal differences between phenomena regard their cause and the context in which they arise. Concerning the source of these problems, the skill gap consists in the lack of the appropriate number of workers because of the failure of education systems in providing students with the right skills. (Cappelli, 2015) On the other hand, skill mismatch is due to the advent of exogenous factors that affect and modify actual job requirements. (e.g., the rising degree of digitization, automation processes, Covid-19 pandemic...) Focusing on the context in which we find them, the skill gap is highlighted at the moment in which employers search for and evaluate job candidates; on the contrary, skill mismatch is verified within workers already hired.

An interesting similarity between the two skill-related problems is that both lead to an imbalance between the supply of and demand for human capital. (Handel, 2003) From BCG research, “*more than 1.3 billion people globally work in jobs for which they are either underqualified or overqualified*” causing higher levels of skill mismatch. The costly consequences consisted of 6% of the global GDP in 2018 and 10% in 2020. The pandemic has aggravated the situation: “*the best-case scenario in a post-COVID-19 world is a loss of around 8% a year by 2025, whereas the worst case is an opportunity cost of 11% of GDP by 2025*”. (Hoteit et al., 2020: p. 2) These divergences have damaging effects on the employment rate and economic growth of a country, leading to further skill gaps and mismatches in a sort of vicious circle. For these reasons, skill-related problems are at the center of the attention of many companies, governments, and institutions.

### *Skilled biased technical change (SBTC) and job polarization*

Another skill-related challenge that can emerge in smart factories is the skilled biased

technical change (SBTC). It is one of the paradoxes that affect the relationship between skills and innovation. Violante (2008: p. 2) defines this phenomenon as “*a shift in the production technology that favors skilled (e.g., more educated, more able, more experienced) labour over unskilled labour by increasing its relative productivity and, therefore, its relative demand*”. This situation is underpinned by the fact that low skilled occupations and routine tasks have been computerized and they can be completed by robots and machines. Job polarization has its causes in the advent of ICT within the workplace and it “*refers to the increasing concentration of employment in the highest- and lowest-wage occupations, as jobs in middle-skill occupations disappear*”. (Jaimovich and Siu, 2020) This phenomenon is caused by the fact that middle-skill occupations are the ones characterized by the highest levels of repetitive and simple activities that can be completed by machines and computers. On the contrary, highest- and lowest-skill occupations cannot be performed by ICT because of their peculiarity and the need for the mental and manual competencies of the human being.

The consequences of both phenomena damage labour market dynamics, especially in advanced economies where they cause increasing numbers of workforce with higher levels of educational attainment, competition between labour force, wage inequality and job and skill polarization. (OECD, 2011)

### **Surviving in the knowledge-based labour market**

In a world characterized by the technological revolution and the outbreak of the pandemic, governments have to take a stand for ensuring the best and fast recovery. The relevance of skills and their role in economic growth and competitiveness led to the establishment of a Pact for Skills (10 November 2020) by the European Commission. It is a “*shared engagement and approach to skills development*” in which individuals, firms and governments contribute to pursuing upskilling and reskilling. (European Commission, 2020 b: p. 1) For the same purpose, already in 2016, the New Skills Agenda was established to support the Member States in understanding the strategic value of skills that can make people more versatile, resilient, and adaptable. (WEF, 2021 c)

Job transition opportunities and the anticipation of labour market changes are becoming priorities both for individuals and governments. The solution is engaging in lifelong learning because it helps individuals remain employable and achieve fulfilling and rewarding careers to maximize employment opportunities. (WEF, 2018 b)



Country governments and companies need to control skill mismatch and skill gap throughout the monitoring of the labour market and understanding their root causes. The next steps are identifying the policy measures that can erase these skill-related problems by promoting upskilling, reskilling and lifelong learning among workers.

Lifelong learning has been already presented in the first chapter, while in the next paragraphs we discuss upskilling and reskilling approaches. They are two processes that differ in terms of scope and steps, but with a shared aim: providing the right set of skills to face the challenges of the actual social and economic ecosystem.

### *Upskilling*

Upskilling means acquiring further new skills that will help people to improve their current job position. (Sivalingam and Mansori, 2020) In other words, upskilling “*refers to the expansion of people’s capabilities and employability so they can fully participate in a rapidly changing economy*”. (WEF, 2021 c: p. 11)

The importance of business investment in this training process is supported by the evidence of a virtuous circle between new technologies and upskilling. It is illustrated in Figure 25 which shows that the upskilling activities within a business have the potential to lead to a better job; this latter can encourage the further development of skills which increase the potential of doing good work; and so on. This phenomenon generally increases the productivity of the business.



**Figure 25:** The virtuous work circle. (WEF, 2021 c: p. 27)

The workforce's KSC and talent can be increased during on-the-job training thus workers can be equipped with the emerging skills to take advantage of new opportunities through continuous retraining and upskilling. (WEF, 2018 a: p. V)

### *Reskilling*

Reskilling means learning entirely new skill sets that will lead to new career positions. (Sivalingam and Mansori, 2020) It is very useful in the case of skill mismatch to solve the incongruence between the demand and supply of skills.

New jobs and technological tools are emerging thus different KSC are required to perform work activities. For example, where job functions are constantly changing, on-the-job learning is more difficult. This is the case of STEM careers in which high ability college graduates exit earlier from these occupations. (Deming and Noray, 2020: p. 2001) The jobs changing faster (STEM occupations have the highest rates of change, p. 1966) need a skilled workforce able to stay updated. This purpose can be obtained through reskilling. The dynamic and changing labour market calls for identifying and mapping out realistic job transition opportunities for workers facing declining job prospects. The possibility of applying workers' skill set in other types of employment is measured by the similarity (similarity score) between different jobs' requirements. The job transition option is desirable if in the long-term there is evidence of non-declining numbers and there is wage continuity or increases. (WEF, 2018 b: p. 4)

Labour market dynamicity and continuous innovation are driven by the necessity of social

and economic growth, but in a fast-changing environment, it is not simple to stay updated and in line with the new trends: this type of context characterizes the digital age. Single actors have to be aware of both difficulties and opportunities that digitalization can offer, conscious of the new and unique value that learning outcomes are obtaining.

## **EMERGING TRENDS IN THE LABOUR MARKET**

This final part of the chapter is focused on skills and not specifically on knowledge or competence because it reflects the great attention that also the European Commission has given to this topic in recent years. The latter has taken a stand in helping people and businesses to recognize and adopt the right skills through the European Skills Agenda. The commission realized that *“in a fast-changing global economy, skills will to a great extent determine competitiveness and the capacity to drive innovation”* being able to ensure a virtuous circle of job creation and growth, but also social cohesion. (European Commission, 2016: p. 2) The particular interest in skills does not overshadow the other two principal learning outcomes because they have a symbiotic relationship: skills cannot be fully explained without mentioning knowledge and competence, as this reasoning works in the opposite direction to define both knowledge and competence.

The third objective discussed in this last section is to monitor the emerging trends that are shaping KSC evolution. The adaptation of human resources to the work environment is the main explanation of KSC evolution. For this reason, observing the birth and change of occupations due to digital progress we can discover the trends that first shape jobs and consequently KSC.

### **Jobs of the future**

The birth of new jobs and the evolution of the existing ones are two of the many effects of digital transformation on the labour market. In the Future of Jobs Report of 2018, the WEF estimates that 75 million jobs may be displaced, while 133 million new occupations may emerge over the 2018–2022 period, because of the market transformation brought about by the Fourth Industrial Revolution. This labour market dynamics adapt to the new division of labour between humans, machines, and algorithms. (WEF, 2018 a: p. viii) In this report, the WEF provided some examples of stable, new, and redundant roles across all industries and it affirmed that emerging professions would have increased the share

of employment from 16% in 2018, to 27%, in 2022. (WEF, 2018 a: p. 9) The Future of Jobs Report of 2020 identified seven key professional clusters as emerging:

| Professional Cluster  | Number of opportunities (per 10,000) |            |
|---|--------------------------------------|------------|
|   | 2020                                 | 2022       |
| <b>figures extrapolated from data for 20 economies (LinkedIn)</b>           |                                      |            |
| Data and AI   | 78                                   | 123        |
| Engineering and Cloud Computing   | 60                                   | 91         |
| People and Culture  | 47                                   | 58         |
| Product Development   | 32                                   | 44         |
| Sales, Marketing and Content  | 87                                   | 125        |
| <b>figures extrapolated from data for the United States (Burning Glass)</b> |                                      |            |
| Care Economy  | 193                                  | 260        |
| Green Economy   | 9                                    | 14         |
| <b>ALL CLUSTERS</b>   | <b>506</b>                           | <b>715</b> |

Note  
 Number of opportunities refers to the number of new opportunities for every 10,000 opportunities in the labour market and is calculated as a compound average annual growth rate.

Sources  
 LinkedIn and Burning Glass Technologies.

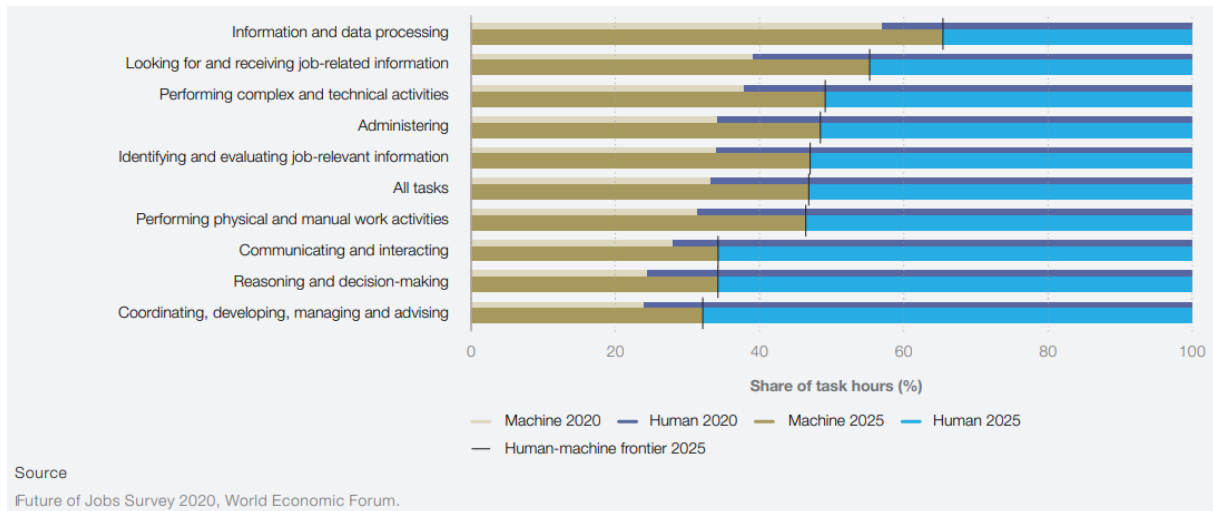
**Figure 26:** Emergence of clusters of professions of the future, 2020-2022. (WEF, 2020 a: p. 8)

The result of this study is the identification of 96 emerging professions (defined as those that have experienced the most growth over the previous 5 years) distributed in the seven clusters. Their growth is driven by two main conditions: the importance of human interaction in the new economy and the necessity of adopting new digital technologies. (WEF, 2020 a) The duality between technology and human beings is found both in the job descriptions and job requirements.

*Cooperation between humans and machines*

The consequences of digitalization can be both positive and negative. The beneficial effect concerns digital innovation and technological facilities introduction across industries, as well as the increasing demand for new job roles and skillsets. Negative effects are related to workforce disruptions: technological adoption affects workers’ jobs by modifying the number of activities completed by humans or machines, and the modalities through which

a specific occupation is performed. (WEF, 2020 c: p. 27) Concerning this phenomenon, it is interesting to look at Figure 27 that shows the share of tasks performed by humans and machines in 2020 (year of the report) and the expected values of 2025.



**Figure 27:** Share of tasks performed by humans vs machines, 2020 and 2025 (expected), by share of companies surveyed. (WEF, 2020 c: p. 29)

The role of machines and robots will increase in all the considered categories pervading the whole economy and society, even though the extent of disruption will vary depending on a worker's occupation and skill set. (WEF, 2020 c)

The data from Figure 27 have not to be considered a negative outcome or resulting in a sort of aversion to the new technologies: machines, especially in Industry 4.0, are not perfect substitutes for workers, on the contrary, they are developed and introduced to support the human being in performing difficult and complex tasks. Tzafestas (2006: p. 1) supports that *“technology must embody a part of the human purpose of production, and it is not designed to replace the skills and abilities of humans, but rather to assist them to be more efficient”*.

The necessary role of the worker is associated with his unique KSC that cannot be replaced by computers or machines. In this regard, the next section will focus on the specific skills the workers of the future should have to be active participants of the knowledge economy and to cooperate effectively with the technologies at their disposal.

## **Skills of the future**

The two trends previously mentioned, digitalization and human interaction, are guiding the development of emerging jobs and doing so they have already shaped the skills of the future, justifying the elaboration of some skill classifications according to their scope and function. For this reason, we have identified some categories of skills to explain the role of digitalization and human interaction in skill evolution and the coexistence of both trends in guiding the establishment of labour market requirements.

The investigation of 21st-century skills will help us to comprehend how skills of the future are more dedicated to cover the fields of ICT use and knowledge, together with human interaction. Furthermore, we will discover that creative and artistic disciplines foster the development of 21st-century skills among students, hence we will review STEM and STEAM education to explain the centrality of the human being in the workplace and society.

## **21st-century skills**

The innovative and complex context of life calls for a more personalized learning approach (deep learning) which provides graduates with the correct range of skills for future jobs and daily activities. (Keane et al., 2013: p. 5) Surface learning is not enough anymore and education has to go beyond the basic 3Rs: Reading, 'Riting and 'Rithmetic (Trilling and Fadel, 2009: p. 176). The new and deeper learning gives the individual the possibility to acquire more specialized skills and specific knowledge and competencies. In this regard, 21st-century skills emerge as a tool to address the turbulent and evolving work environment in which technology improves skills as the technology itself develops. (Tzafestas, 2006: p. 1)

### *ICT and 21st-century skills*

*“Information and Communication Technology (ICT) is at the core of 21st-century skills. Specifically, it is regarded as both (a) an argument for the need for 21st-century skills, and (b) a tool that can support the acquisition and assessment of these skills. In addition, the rapid development of ICT requires a whole new set of competencies related to ICT and technological literacy”.* Voogt and Roblin (2010: p. i) affirmed that ICT technologies are both the reason why 21st-century skills are emerging and evolving, and the mean through

which such skills can be learnt, acquired, and shared. The relationship between 21st-century skills and the technological environment is mutually beneficial. Skills allow us to live and operate in this digital context characterized by many facilities and communication tools; on the other hand, the development of ICT calls for the birth and evolution of new skills.

Sometimes, the closer dependence between ICT and emerging skills made us misunderstand the boundaries of 21st-century skills. In the past, they have been compared and even overlapped with digital skills or ICT-related competencies but the two concepts are distinct. (Voogt and Roblin, 2010: p. 20) In studying the relation between 21st-century skills and digital skills, Van Laar et al. (2017, p. 582) concluded that the firsts are broader than digital skills because they are not necessarily supported by ICT, while digital skills do. ICT-related competencies are *“associated...[with] a whole new set of competencies about how to effectively use, manage, evaluate, and produce information across different types of media”*. (Voogt and Roblin, 2010: p. 20) Hence, they can be included in the wide range of 21st-century skills, as many frameworks do.

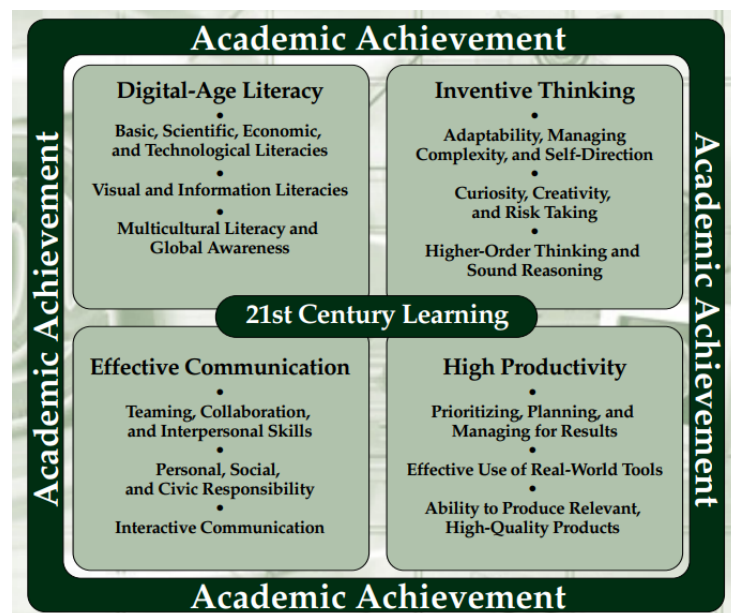
The overarching meaning and role of 21st-century skills make them have a higher potential, both compared to the last century skills and also to the digital ones. They are the driving force of organizations' competitiveness and innovation. (Van Laar et al., 2017: p. 582)

### *Framework presentation*

21st-century skills have been studied and investigated by many researchers and organizations as a result of their rapid and consolidated growth. We decided to analyze four of the various frameworks that have been developed for categorizing the skills people should possess to be qualified workers and active citizens in the present and future years. We reviewed the categorizations of the OECD and the Assessment & Teaching of 21st-Century Skills (ATC21S), the enGauge 21st Century Skills from the North Central Regional Educational Laboratory (NCREL) of the U.S. Department of Education and the Framework for 21st Century Learning from the Partnership for 21st Century Learning (P21). The choice of these classifications follows two guiding principles: examining reference frameworks of different years to understand how knowledge of the subject has evolved and choosing the most complete and detailed ones.

The NCREL, with Metiri Group, provides the enGauge 21st Century Skills. Figure 28 displays this “new Web-based framework” that individuates four categories of 21st-Century Skills:

- Digital-Age Literacy skills are the ones that people need to learn and use to live and work in the actual digital world.
- Inventive Thinking skills or “life skills” consist of being creative and solving the higher-level challenges of this technological age.
- Effective Communication skills are essential for success in today’s knowledge-based society.
- High Productivity skills determine whether a person succeeds or fails in the workforce. (Lemke, 2002)



**Figure 28:** enGauge 21st Century Skills. (Lemke, 2002: p. 5)

In 2009, the OECD defined these skills of the future as the means through which students and young people will deal with 21st-century’s knowledge society. (Ananiadou and Claro, 2009: p. 8). They can be thought of in terms of three dimensions:

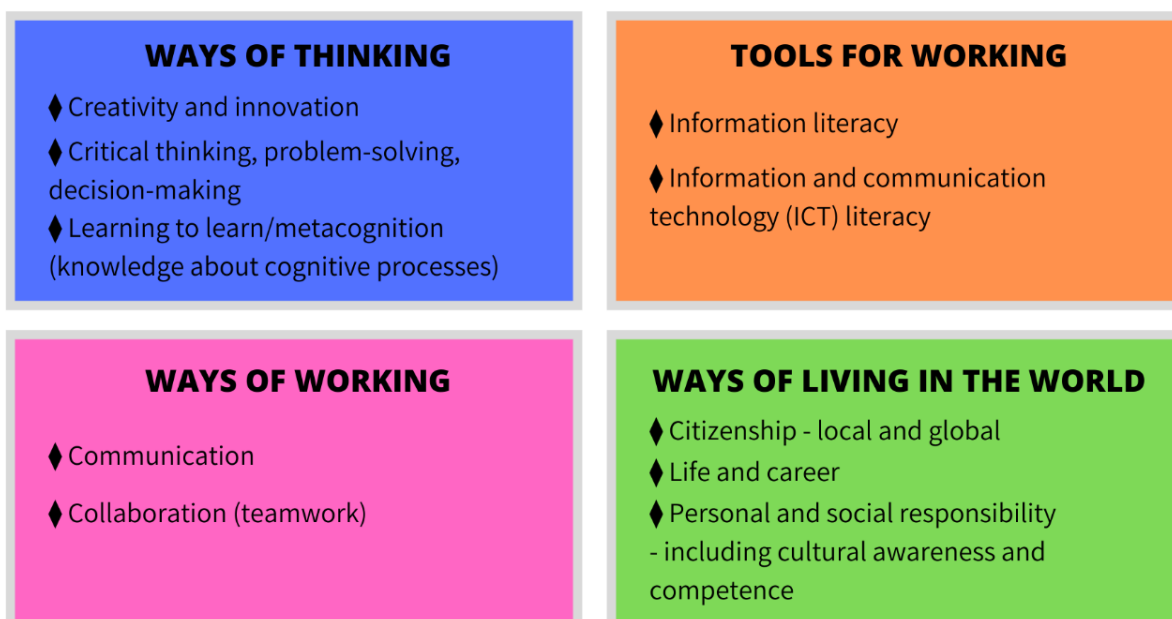
- The information dimension is related to Information and Communication Technologies (ICT) skills and it is related to the digital progress brought by Industry 4.0.
- The communication dimension concerns the fact that individuals have to be



learners but also citizens. Being part of a society means being able to communicate with others, to express your point of view and to have a critical approach towards others and the surrounding environment.

- The ethics and social impact dimension comes from the advent of globalization and multiculturalism. Nowadays the global population is closer and more interconnected: people need to develop a sense of belonging and responsibility towards others. (Ananiadou and Claro, 2009: pp. 8-11).

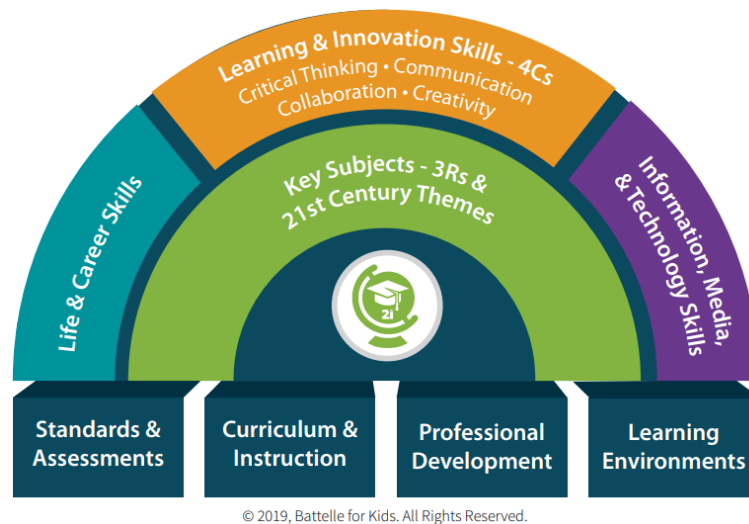
The ATC21S is a project sponsored by Cisco, Intel and Microsoft that searches for new types of skills, learning processes and ways of assessing skills to provide students with higher-order performances. (Binkley et al., 2012: p. 12) The outcome of this project is a framework named the KSAVE model, which originated from the acronym composed of the initial letters of knowledge, skills, attitudes, values, and ethics. (Binkley et al., 2012: p. 6) The model is illustrated in Figure 29 and it identifies ten 21st-century skills grouped into four broad categories.



For further detail please see: Binkley, M., Erstad, O., Hermna, J., Raizen, S., Ripley, M., Miller-Ricci, M., & Rumble, M. (2012). Defining Twenty-First Century Skills. In Griffin, P., Care, E., & McGaw, B. Assessment and Teaching of 21st Century Skills, Dordrecht, Springer.

**Figure 29:** 21st Century Skills. (ATC21S, 2021)

The P21 has designed the Framework for 21st Century Learning which includes skills, knowledge and expertise graduates have to possess to have success in their job and their whole life. (Battelle for Kids, 2019: p. 2) The framework, also known as the 21st Century Knowledge-and-Skills Rainbow or 21st Century Learning Framework is presented in Figure 30.



**Figure 30:** 21st Century Learning Framework. (Battelle for Kids, 2019: p. 2)

The three fundamental types of skills are:

- Learning and Innovation Skills include the 4Cs skills: Critical thinking, Communication, Collaboration and Creativity, whose dates back to Keane et al. (2013).
- Information, Media, and Technology Skills refer to the ability to operate in the technological circumstances brought by the digital transformation.
- Life and Career Skills are necessary to address life and work environments in the globally competitive information age. (Battelle for Kids, 2019: p. 6)

#### *Framework comparison: three common guidelines*

The frameworks and models presented above demonstrate that a common and unified definition of 21st-century skills is not available yet. The reasons for such uncertainty are the complexity of the emerging digital technologies and innovations, but also the continuously changing nature of the work environment. Even though there is not a unique

meaning and list for these 21st-century skills, we can deduct the principal common points and take them as a general reference.

Reviewing the previous frameworks, we recognize that the three main dimensions elaborated by OECD are recurrent in the other proposals. The information dimension, about ICT skills and literacy, is recalled by NCREL in its Digital-age literacy skills, by ATC21S in the group of Tools for Working and by P21 in the Information, Media, and Technology Skills category. The communication dimension is the same underpinned by the Effective communication category of NCREL. Furthermore, communication is considered a 21st-century skill together with collaboration in the Ways of Working from KSAVE model (ATC21S) and in the Learning and Innovation skills from the P21 framework. The dimension concerning Ethic and Social impact is about the sense of belonging and responsibility towards others. It is embodied by the Ways of Living in the World (ATC21S), which include citizenship; life and career; personal and social responsibility. The Life and Career skills are also in the 21st Century Learning Framework (P21).

The presence of the three dimensions in all the models justifies our choice of considering them as the necessary conditions that guide the selection of 21st-century skills. Further support for this assumption comes from the fact that these dimensions embody the two trends previously mentioned when examining the jobs of the future: digitalization and human interaction. The first trend is represented by the information dimension that, concerning ICT knowledge and use, requires the development of skills like ICT and scientific literacies. Human interaction shapes the skills of the future through the fulfilment of the communication dimension identifying communication, teamwork, and interpersonal skills like the ones to be skilled workers and good citizens. The ethic and social impact dimension could include the human interaction condition too given the necessity of communicating and collaborating to be socially responsible.

#### *A further guideline: the creativity dimension*

We decided to add a further dimension as a guideline for the identification of 21st-century skills: the creativity dimension. This choice is supported by the recurrent presence of creativity and related skills within the compared frameworks. In the enGauge 21st Century Skills from NCREL, we can find the category of Inventive Thinking that include skills like curiosity, creativity, adaptability, and high order thinking. The KSAVE model

mentions creativity and innovation; critical thinking, problem-solving and decision making; together with learning to learn skills (Ways of Thinking group). Within Learning and Innovation skills from the 21st Century Learning Framework (P21), we can find creativity and critical thinking.

The reason for the inclusion of creativity in the skills of the future can be found in the fact that creativity fosters the generation of ideas, which in turn provide the foundation for all innovations; and the latter are the main drivers of competitiveness in the knowledge economy. (Skippington, 2016) Another point in favor of identifying creativity as a 21st-century skill is that it is essential to the human being: this brings the worker at the center of the workplace, the student at the center of the education system and the person at the center of the society. Human centrality is confirmed as one of the trends shaping both job and life.

Once having realized the importance and role of 21st-century skills in addressing future work and life challenges we need to focus on the process through which these tools can be acquired and developed. In the next paragraph, our attention moves on the STEM and STEAM approaches with the final aim of explaining the role of Arts in developing students' higher-order skills through the integration of different disciplines. (Hadinugrahaningsih et al., 2017)

### **STEM education and related skills**

Before examining the reasons and consequences of the implementation of Arts in the most technical and scientific fields, we must first know what is the field of STEM education and its skills and why they have been updated in a logic of digital progress.

The European Commission (2016: p. 7) affirms that the acronym STEM is used to mention study disciplines, labour markets and occupations in the field of Science, Technology, Engineering and Mathematics. According to the UK Commission for Employment and Skills (UKCES, 2011: p. 5) STEM skills are the ones that “*support scientific enquiry and research, and the growth of [the respective] disciplines*” and they have been identified in the following ones:

- data analysis and interpretation skills
- research and experimental design skills
- testing hypotheses skills

- analysis and problem-solving skills
- technical skills

The growing importance of STEM skills is justified by some determinants. Firstly, competitive advantage is becoming more and more difficult to reach in the actual complex and digital ecosystem and a potential solution for companies are STEM skills. The latter *“are associated with advanced technical skills, which are seen as strong drivers for technology and knowledge-driven growth and productivity”*. (European Commission, 2016: p. 1) Secondly, STEM skills demand does not always meet the effective supply. Indeed, *“only one in five young people in Europe graduates from STEM tertiary education”*. (European Commission, 2020: p. 13) To prevent labour market disequilibrium, the interest in future STEM workers rose. Thirdly, *“education systems play a broad role in supporting innovation because knowledge-based societies rely on a highly qualified and flexible labour force in all sectors of the economy and society”*. (OECD, 2010: p. 44) The lack of STEM education has direct and dramatic consequences on the labour market, hence governments and institutional organizations put attention to such specific types of education.

#### *STEM skills growth in terms of demand and supply*

The demand for STEM skills is one of the main drivers for the development of educational systems and training programs to prepare graduates for meeting employers' requests. Thus, the increasing demand for STEM qualifications will modify the composition of instruction levels and the distribution of workers within the various productive sectors. (Unioncamere – ANPAL, Sistema Informativo Excelsior, 2020 b: p. 32)

The growing trend of STEM skills demand is justified since 2013 when the employment of STEM professionals was around 12% higher in the European Union compared to 2000. (Cedefop, 2014) The growing STEM careers trend has been very diffused in Europe for many years. Just think that between 2007 and 2012, the total number of STEM graduates increased with an average annual 3.8% growth rate and an overall 20% increase. (European Commission, 2016: p. 12-13) In 2014, Cedefop estimated that demand for STEM professionals would have risen by around 8% between that year and 2025. This percentage is surprising because the average growth forecast for all occupations was about 3%. The Excelsior Information System surveys on forecasts of employment needs in Italy estimates that the requested quota of technical and specialized figures in the 2020-

2024 period would have been approximately 44% of total demand. Moreover, in this five-year term, the comparison between demand and supply of new graduates proved that a potential gap in STEM occupations could emerge. (Unioncamere – ANPAL, Sistema Informativo Excelsior, 2020 b: p. 37) Already in 2011, it was realized that the lack of STEM skills workers would be one of the obstacles to economic growth in the upcoming years. (BusinessEurope, 2011: p. 5).

Once having addressed the growth of the demand for STEM workers and related skills we need to move on the supply side: *“the annual supply of STEM skills...equates to the number of graduates from degree-level STEM programs and the stock of STEM skills to the number of STEM degree-holders in the workforce”*. (UKCES, 2011: p. 5)

Some of the main factors that affect STEM skills supply are age, gender, and mobility patterns. Concerning the demographic aspect, the advanced age of STEM professionals will result in a significant demand for STEM professionals now and in the coming years with potential future deficiencies. (European Commission, 2016: p. 11)

Regarding the gender gap phenomenon, it is unfortunately present in many fields including STEM careers. For example, in Italy in the academic year 2018/2019, the students who attend a STEM course were for the most part male (63%) compared to the female participants (37%). (For the detailed data see the graph on page 8, Assolombarda, 2020) In an OECD study about unbalanced gender employment in science careers, Mostafa (2019: p. 2) tries to explain the reason for such gender gap and he reveals that such difference in confidence and interest in science is connected with a lower level of women graduates in STEM disciplines. Hence, STEM availability in educational courses affects a lot the distribution of males and females within technical careers.

The focus on mobility patterns regards the phenomenon through which people are closer thanks to globalization, new ways of communication and faster transportation systems. Nowadays, companies can find candidates from all around the world and people can apply for jobs in other countries or even continents from their homes. The European Commission (2016: p. 14) clarifies that the supply of STEM graduates depends also on the number and qualification of students arriving from other States. Foreign graduates are searching for employment that matches their qualifications and level of skills and they can likely face the demand of STEM graduates better than the graduates from the original country.

## **The need for a STEAM approach**

*“Whilst the numbers of STEM students and graduates are both increasing, some employers report that they are not ‘job ready’ and do not possess the ‘right’ skills, especially soft skills”.* (European Commission, 2015: p. 1) These employability skills include team working, communication, time management/organizational skills and the more commercially related skills like product development, customer service and business acumen.

The presence of under-skilled graduates means that the education they have received was not aligned with the requirements of the labour market and the global trends. The gap between demand and supply of competencies is due to the continuous evolution of KSC as technology changes and innovations occur, so establishing the perfect educational program is almost impossible. (Chaniel Fan and Ritz, 2014: p. 8)

The need for covering this gap led to the advance of many studies about the relationship between human capital and performance (Grant, 1996. p. 380), the emergence of new skills in the 21st-century (Ananiadou and Claro, 2009; Battelle for Kids, 2019; Binkley et al., 2012; Keane et al., 2016; Lemke, 2002; Trilling and Fadel, 2009; Van Laar et al., 2017) and the investigation of STEM occupations and related skills (Cedefop, 2014; Chaniel Fan and Ritz, 2014; European Commission, 2015 and 2016; Unioncamere – ANPAL, Sistema Informativo Excelsior, 2020 b; UKCES, 2011). Recent research has focused on the introduction of creative and artistic workers in the company workforce and business environment. A reason that motivates this type of research is that *“many faculties and practitioners in STEM have lost their ties to creativity, abstract reasoning and divergent thinking; similarly, many in the arts community have failed to keep up with rapidly evolving digital technology (such as 3D printing etc.)”.* (McAuliffe, 2016: p. 1)

The emergence of integration between disciplines pushed scholars to investigate this potential collaboration and the benefits that could emerge. One of the first studies about this topic has been done by Florida (2002) who questioned the hypothesis that bohemians, or eccentric, alternative, and creative types of people, can attract other types of talented or high human capital individuals in the area in which they operate. (p. 56) Florida finds strong evidence that the *“presence of such human capital concentrations in a region in turns attracts and generates innovative technology-based industries”.* (p. 67) This new environment is characterized by openness and attractiveness which stimulates innovation and creativity. The ideas of Florida have been supported also by Huggins and Clifton (2011: p. 1346) who affirmed that human capital and creativity help to be

successful in the knowledge economy. According to the authors, “*regions must develop, attract, and retain talented and creative people who generate innovations, develop technology-intensive industries, and power economic growth*”. In 2013, Daugherty (p. 11) recognized that companies, about twenty years before, were already searching for creative people, acknowledging them as growth drivers.

Another evidence of the role of creative people in generating further innovation and business competitiveness is provided by Rodríguez-Pose (2020) whose study focuses on the role of Geeks (STEM workers) and Hipsters (creative workers). The author discovered that “*STEM alone may be positively linked with innovation, but the biggest effect occurs in combination with many creative activities that can help develop and market these innovations*”. Hence, the most innovative cities combine both Geeks and Hipsters given the beneficial effects of a balanced strategy between the interaction of their different KSC. (Rodríguez-Pose, 2020: p. 8)

The rising importance of art and its positive effects drove scholars to think about its introduction in the STEM acronym: it was coined the acronym STEAM that wants to give voice to the role of this discipline. (White, n.d.)

### *Why art and creative disciplines are important*

Throughout STEAM disciplines people can combine the best STEM education and the best creativity and innovation education for a whole-brain system. (White, n.d.) Root-Bernstein (2011) sustains this opening to artistic subjects saying that “*arts provide innovations through analogies, models, skills, structures, techniques, methods, and knowledge*”. According to him, the connection between STEM disciplines and arts is evident and it can be demonstrated by the fact that some widely adopted inventions have been created by designers, artists, and musicians. (Root-Bernstein, 2011)

The identification of creative workers and related occupations is not simple. Florida (2014: p. 197) defines the creative class as the “*jobs in knowledge-intensive industries that involve the production of new ideas and products, or that engage in creative problem solving*”. This broad explanation embodies in creative workers the fundamental elements of creativity and innovation, essential for reaching competitiveness and effectiveness. Concerning creative occupations Florida (2014: p. 197) includes many categories: design, entertainment, and media; computer and mathematical sciences; management; law; architecture and engineering; medicine; finance; life, physical, and social sciences;



education; and of course, the super-creative occupations like university professors, thought leaders, actors, musicians, dancers, novelists, and poets.

STEAM has been defined by McAuliffe (2016: p. 4) as a “*cross-curricular collaboration*” highlighting the importance of multidisciplinary. This reflects the need for people to acquire the right skills which can go from the more scientific to the more humanistic ones. We can conclude that artistic and creative disciplines help the human mind to develop alternative ways of conceiving the surrounding context, new and creative solutions and out of the box thinking. These human contributions are part of 21st-century skills which can be distinguished by their transversal and multifunctional aspects that make them independent from context. (González-Salamanca, Agudelo and Salinas, 2020)

## **FINAL CONSIDERATIONS**

The advent of the digital revolution and ICT have profoundly changed the business and social environment; the Covid-19 pandemic has accelerated even more the emergence of the need for digitalization and human interaction. People had to revolutionize their way of working and living and they had to realize that new types of KSC were required to perform their job or simply to stay connected with people.

In this complex situation, skills are essential to grow and to recover from the damaging effects of the challenging circumstances. Individuals, companies, and policymakers need to be focused on lifelong learning, upskilling, and reskilling to pursue continuing education and training, which are the main ways to keep pace with the complex knowledge society. To achieve these purposes, global actors have to aspire at shared taxonomies and definitions of the concepts that facilitate productive dialogue and create a path for preventing and detecting future labour market issues.

This SLR want to contribute to this objective by proving a comprehensive and clear framework about KSC meanings and by identifying the emerging trends that are making them relevant in the actual and future labour markets. The main findings of the research consist in having recognized the two dimensions of 21st-century skills evolution (digitalization and human interaction) and the evidence of artistic disciplines (STEAM approach) in fostering the development of high-order skills like creativity, critical thinking, and collaboration. The results show that education systems, work training

programs and institutional organizations have to ensure KSC evolution according to the digital progress.

We conclude our considerations highlighting how the study affirms the central role of the human being in the digital age: “it is people who develop, carry, react to and modify ideas towards fruition” and only people can generate innovation and further growth, both in economic and social terms. (Skippington, 2016: p. 68) In this light, global parties have to believe in the future generations and to offer to young people of today the possibility of receiving the appropriate education for ensuring the growth of tomorrow.

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